Design News

Cycloidal-cam speed reducer achieves high ratios, saves weight. P. 6

A CAHNERS PUBLICATION

AUGUST 18, 1961

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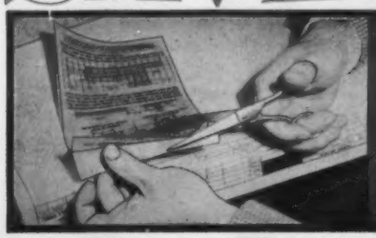

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SOUNDING BOARD

FOR OUR READERS

Defense Department Appropriation

DESIGN NEWS received permission to print the following letter in its entirety as a public service.

The Honorable Estes Kefauver
United States Senate
Senate Office Building
Washington 25, D. C.
Subject: HR 7851/Defense Department Appropriation
My Dear Senator Kefauver:
When I read Bill HR 7851 I noted the statement —"No part of the funds appropriated herein shall be available for paying costs of advertising by any defense contractor, and such costs shall not be considered a part of any defense contract cost." I am extremely surprised and bewildered at the constant effort by some of our people to try to break down the free enterprise system of America.

For years now I have heard remarks by various people working for our various government agencies:

(a) "You do not advertise to secure business from the government."
(b) "You do not sell the government—the government buys."

These two remarks reflect one of two things—stupidity or anti-Americanism.

We are a small manufacturing company that has conceived, developed and manufactured many products which we sell to all segments of industry, including various government agencies of the people. Personnel of the various government agencies learn of our products through our advertising and write to us for information, the same as all other segments of industry. We send these various government representatives this information and then follow it up with technical sales calls exactly the same as we do with private industries. Based on experience, the monies we have spent on advertising and engineering sales calls have saved the government untold amounts of money, the same as all other industries.

It does not take the wisdom of the Prophets to determine the necessity of advertising. Why does the Congress of the United States want to deprive our government representatives of the information that is so essential to accomplishing successful results?

We strongly urge that Defense Department Appropriation Bill HR 7851 have stricken from it the provision relating to advertising costs of defense contracts.

Respectfully yours,
HUGH C. ROBBINS
President
Robbins Aviation, Inc.

Discoverer Spin Tests

Your article entitled "Bowling Ball Serves as Air Bearing Journal in Discoverer Spin Tests", appearing in the May issue, was certainly of extreme interest and was excellent testimony to the effort of DESIGN NEWS in digging out new, original design applications.

However, it appears that the cause of the difficulties encountered in recovering Discoverer satellites may have been over-generalized in your first paragraph. The attached booklet summarizing the re-entry/recovery portion of the Discoverer program should be of interest to you in helping to clarify the matter.

J. C. HOFFMAN
Manager—Product Information
General Electric Co.
Missile & Space Vehicle Dept.
Philadelphia, Pa.

• USAF Space Systems Div. advises that there was no indication of spin system operation on Discoverer XI. The spin system and other items were changed. A successful recovery was made on Discoverer XIII. Each test shot in the development program has added knowledge leading to design improvements in all phases of re-entry/recovery.

So Johnny Can't Write . . .

Your editorial, "So Johnny Can't Write. . .", intrigued me very much. After teaching college math for a number of years, I, too, came to the conclusion that college remedial work should better be done in high school or grade school.

Your suggestion that home training is the real answer intrigued me even more. The implication is that parents can teach and with this I disagree to a degree. First of all, I believe it would be safe to conclude that parents are less prepared, on the average, to teach their children English than the English teachers referred to in your source. Second, have you as a parent ever tried to teach your child in an area of your specialty, such as math or piano? A general comment that I get from parents indicates that patience runs out the window very quickly because of an inability of parents to accept a slower grasp of principle than that of which they think they are capable.

I am not sure that there is a panacea to this problem. A positive suggestion may be for the parents to improve themselves beyond their present capability in English, then to set an atmosphere or environment in the home to which the child will be challenged to reach. . .

JOEL STRANDBERG
Nortronics
Div., Northrop Corp.
Hawthorne, Calif.

Fourth Dimension

"The designer thinks scientifically as well as creatively. He designs with facts as well as ideas. He has to know materials and markets as well as forms and functions. He must never forget that a company is known by its end products in the hands of the public. The results of his decisions with respect to the appearance and function of industrial products are soon reflected in the profits or losses of the company he serves."

These words from Bay E. Estes, Jr., Vice President-Marketing, U. S. Steel Corp., spoken before a group of industrial designers, are just as applicable to mechanical and electrical designers. Mr. Estes went on to say that manufacturers of raw materials such as steel do not profess to be product designers. They are, however, a major source of engineering information about their materials.

A case in point is the technical paper presented on page 100 of this issue. Entitled provocatively "The Fourth Dimension in Design", this paper represents scientific thinking in the true sense of the word.

Most designers think of steel as being a single material with a given set of properties that are useful for heavy structures. Like many other materials, however, steel is made up of literally thousands of different types with varying properties. By using various types of steel on one structure or one machine, it is possible to realize important savings not only in money but also in weight and bulk.

It has been said with some truth that all design is compromise. Sometimes the compromise is with the cost factor. Sometimes it is in the field of weight. Compromises sometimes have to be made in many other ways as well. The most successful designer is the one who can make the best use of the knowledge at his fingertips.

It is with this thought that we have arranged with the U. S. Steel Corp. to make available to you the full contents of "The Fourth Dimension in Design" in pamphlet form. I know you will find it an interesting and informative addition to your design library, as I did.

J. R. Dacey

Executive Editor

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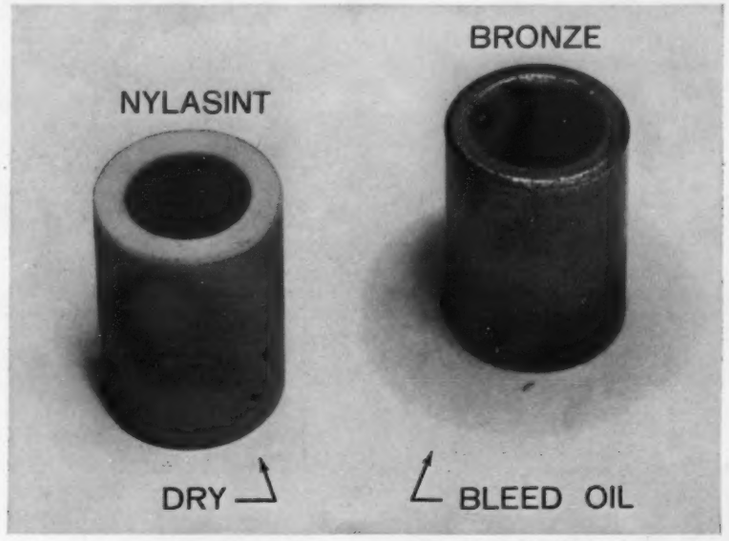

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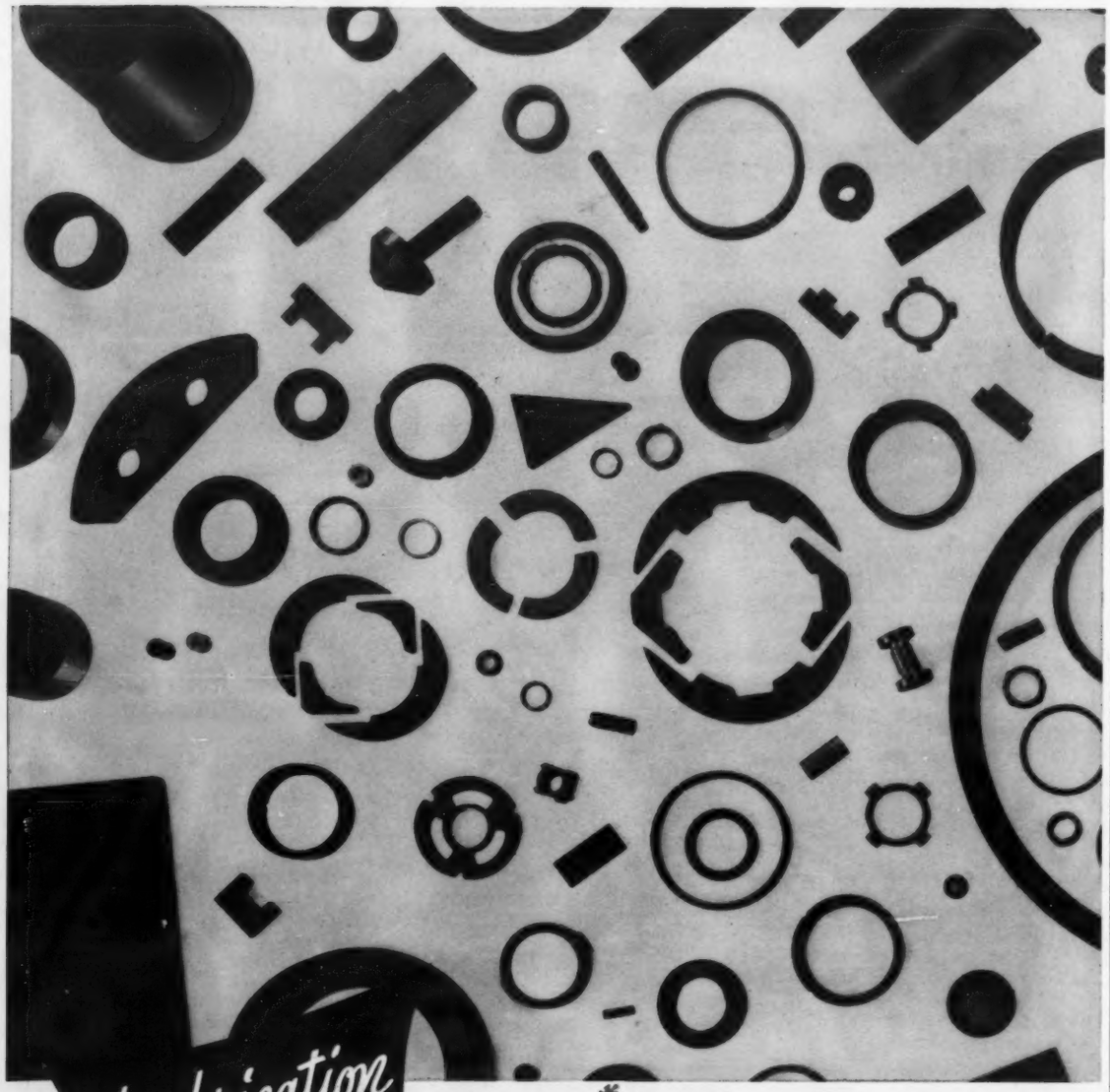
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SEEN AND HEARD

M. E.—Medical Engineer

Victor W. Wigotsky, Eastern Editor

I attended some of the meetings of the Fourth International Conference on Medical Electronics held in New York recently with a feeling of being somewhat of a maverick. At least I felt this way until I encountered Dr. Lee B. Lusted, Professor of Bio-Medical Engineering in the Engineering School and Associate Professor of Radiology in the Medical School of the University of Rochester.

The first question I asked him was why engineering developments in the medical field are almost always related to the term "medical electronics". In other words, are mechanical engineers essentially second cousins in this mushrooming new field in which electronic engineers apparently supply the leadership? Must mechanical engineers, rather than functioning on a primary level, wait in the wings until the electronics people indicate just what mechanical hardware is needed in their black boxes?

Dr. Lusted put some of my concern about this to rest. "The mechanical aspects of bio-medical engineering," he said, "are undeveloped, compared to electronics. For example, consider the stresses and strains on body tissue, muscle and bones in the acceleration and deceleration of rocket flight. These are very urgent problems where mechanical principles can be applied usefully. The mechanical properties of tissues are not well defined, compared to the much better understood electrical properties, such as resistive and capacitive effects. Also, as another example, familiarity with the problems of elasticity could help in better understanding of such things as hardening of the arteries, or the aging process."

The importance of developing the bio-medical engineering field has been recognized in some university engineering departments and medical schools, as well as the National Institutes of Health. The University of Rochester, University of Pennsylvania and Johns Hopkins University are each receiving from N.I.H. approximately $50,000 a year for a period of five years to develop the bio-medical engineering field. At these schools, an engineering graduate degree program, based on fellowship awards, is being run jointly by the university's engineering and medical schools. For example, at Rochester, the mechanical engineer would receive a Master's or Ph.D. degree in Me-

chanical Engineering from the Engineering College. His thesis would be on a problem from the fields of biology or medicine. On the basis of present experience, for a Ph.D. in engineering, about 2/3 of the hours would be spent in engineering and 1/3 in either biology or medicine.

Entrance requirements are the same as those required for entering any graduate engineering school. No experience in biology is necessary, since the plan, starting its second year this fall, provides for making up lack of training in this area. There are perhaps a half-dozen schools that are now in the process of starting this program, and it seems fair to assume that this will double in three years.

How about job opportunities, after this dual discipline is completed? There are three major areas. One, people are needed to remain in the teaching field to start and help expand programs. Second, the military and industry need help relative to space flight development. The third area would be in bio-medical research in medical schools, large teaching and research hospitals, and the National Institutes of Health.

At one of the large discussion meetings of the International Conference, a show of hands was asked to indicate proportional attendance of engineers and physicians. I was amazed at the even distribution of physicians and engineers. This certainly is an indication of the significance that physicians attach to this whole program of the engineer's role in medicine and his growing feeling of interdependence with the engineer.

Dr. Lusted emphasizes that the graduate programs at the various universities are called programs in "bio-medical engineering", which includes the whole field of engineering — mechanical, chemical, electrical, optic, and so on. Not just "Medical Electronics".

I am glad that the field is broadening. There's room for competent mechanical engineers, interested in working on a primary level in this highly important area and who can hold their own against the "semiconductor experts".

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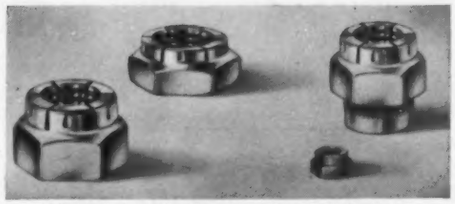

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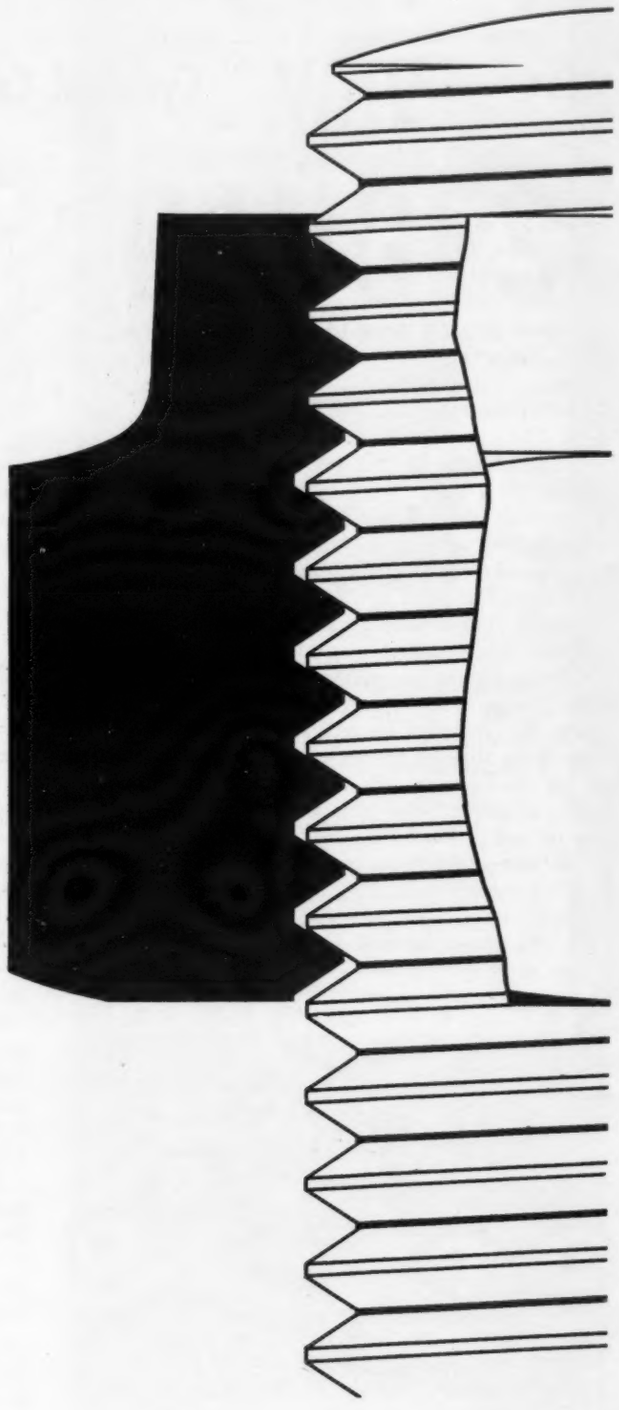

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Cycloidal Cam Reducer Gives Higher Efficiencies

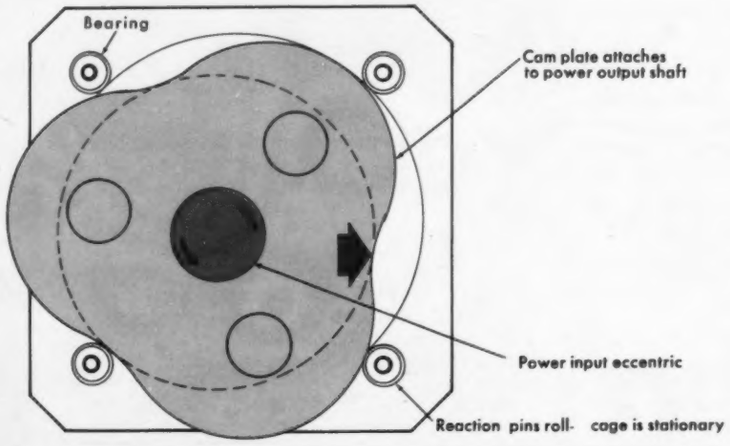
Edward W. Schrader, Western Editor

Drive elements in the cycloidal cam transmission remain in constant engagement; whereas, in gear reducers, the load is carried by a relatively few number of teeth in mesh at any given instant. In theory, the absence of mesh interruptions as occasioned in gears eliminates noise, heating, backlash and roughness, and inhibits the generation of destructive dynamic loads. The energy conserved might be reflected in greater efficiencies.

The transmission uses an eccentric input, a cam plate whose peripheral surface is continuously profiled with a sequential series of identical cam lobes, reaction pins and reverter pins. The cycloidal cam principle appears to have a more fundamental reason for basic superiority over contemporary gear design. The latter supports both rolling and sliding action. The cycloid permits only pure rolling because it is described by a point in the plane of one circle as it rolls on another.

The epicycloid is a curve generated by a point on the circumference of a circle as it in turn rolls without slipping on the outside of a fixed circle. If the tracing point lies within the circumference of the rolling circle or generating circle, it is a special case and it is called a prolate epitrochoid. This special case avoids the cusp, inherent in the epicycloid. This type of generating circle is adaptable to the design of multilobed cycloidal cams.

The epicycloid begins and ends abruptly at the base circle in a discontinuous cusp. A roller of any diameter other than a point could not traverse this path. The epitrochoid is more adaptable since it can accommodate a finite pin size, though pin size is limited in diameter. When strength considerations require a heavier pin, the design must resort to the equidistant curve. This curve is generated by making the epitrochoid the centrode for a system of circles equal in diameter to the required pin size.



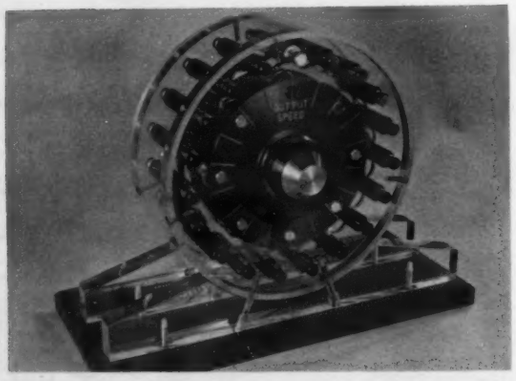
SIMPLIFIED DIAGRAM illustrates means of speed reduction. As power input eccentric rotates one revolution counter-clockwise, cam plate attached to power output shaft rotates clockwise 1/3 revolution. Three cam lobes in diagram wedge against four reaction pins, causing rotation in opposite direction. Generated cam surface is of epicyclic family to give rolling action between cam plate edges and stationary reaction pins. Design uses odd number of lobes and even number of reaction pins. One more pin is required than number of lobes.

Transmission Design

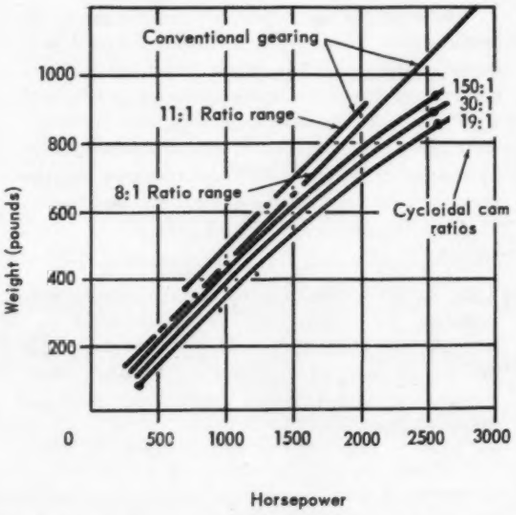
Eccentrics on the input shaft force the cam lobes (which are the equidistant curves of an epitroichoidal shape) against the fixed pins with a wedging action. The reaction turns the cams on their own centers by the amount of one lobe pitch for each revolution of the input shaft. Reverting pins and holes in the cam plates translate the cam revolutions to the output plate or shaft with uniform velocity. Three cam plates are used.

The cycloidal cam transmission is a design development of the Systems Management Div., Western Gear Corp., Lynwood, Calif. It is being built for U. S. Army Transportation Research Command, Fort Eustis, Va.

Development consists of three phases; study, design and fabrication. First two phases are completed. The cycloidal cam design may be applied in military aircraft, including VTOL, helicopters and ground-effect vehicles.

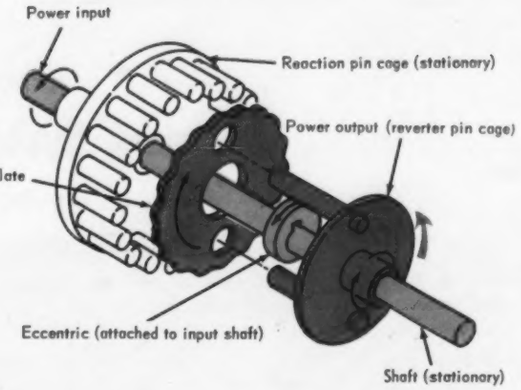


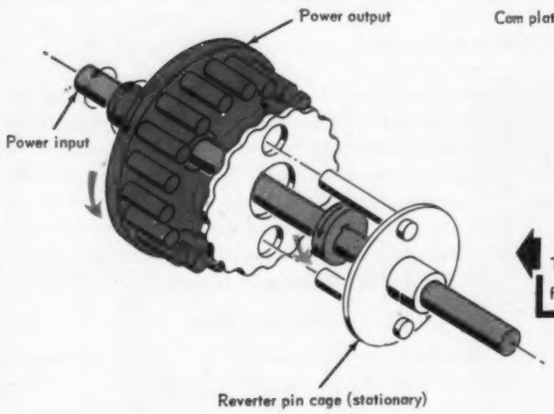
PLASTIC MODEL demonstrates feasibility of design.



GRAPH compares weight per horsepower of cycloidal cam transmission with conventional gearing. Considerable weight saving is projected for greater speed reduction with cycloidal cam transmission.

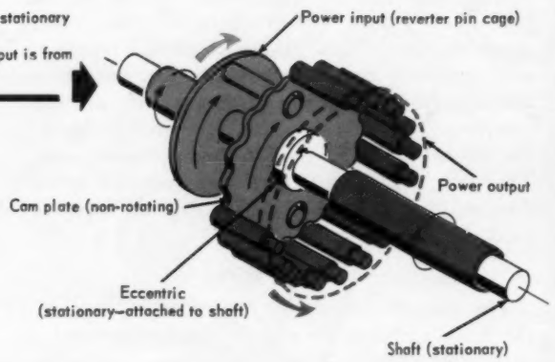
Type A system gives output ratio of $\frac{1}{n}$ where n equals number of cam lobes. In this case, reaction pin cage is stationary and reverter pin cage is power output.

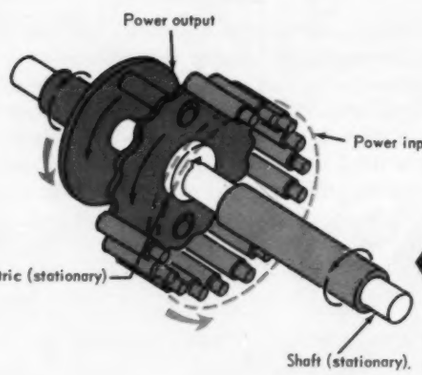




Type B system gives output ratio of $\frac{1}{n+1}$. Reaction pin cage rotates for power output and reverter pin cage is stationary.

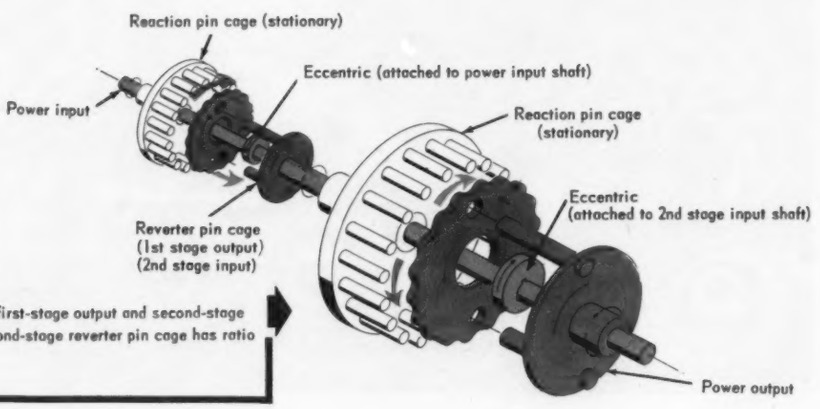
Type C system gives output ratio of $\frac{n}{n+1}$. Eccentric is stationary and power input is through reverter pin cage. Power output is from reaction pin cage.





Type D system gives output ratio of $\frac{n+1}{n}$. Eccentric is stationary and power input is through reaction pin cage. Power output is from reverter pin cage.

Input
Output
Fixed



Rotating reverter pin cage is first-stage output and second-stage input. Power output from second-stage reverter pin cage has ratio equal $\left(\frac{1}{N_1}\right)\left(\frac{1}{N_2}\right)$

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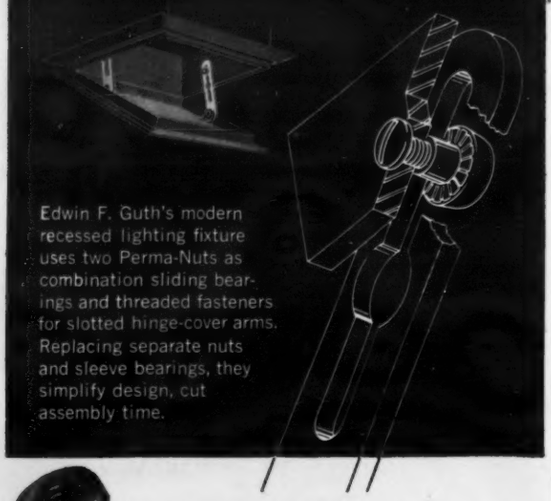

Edwin F. Guth's modern recessed lighting fixture uses two Perma-Nuts as combination sliding bearings and threaded fasteners for slotted hinge-cover arms. Replacing separate nuts and sleeve bearings, they simplify design, cut assembly time.

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Tensioning Systems Allow Stringing of Barbed

E. J. Stefanides, Central States Editor

A machine for fence building is equipped with two separate means for wire dispensing and tensioning which allow separate or simultaneous stringing of both barbed and woven wire. Incorporating a power-operated post driver and other power-operated or automatic devices, the machine eliminates the heavy manual labor previously associated with fence erection. The elimination of the heavy labor reduces the time and cost of fence building by as much as one-half to two-thirds of that required by manual methods.

Tractor Towed

The equipment consists of three units: a power-take-off-operated post driver which mounts on the rear of the tractor, and two semimounted, trailer platforms. One of these platforms carries a supply of wire and posts, the other carries the wire-dispensing and stretching equipment. The platforms are suspended independently so that they are flexible in the vertical plane but rigid in the horizontal plane. They may be hitched to permit straddle line operation or operation alongside an existing fence or natural obstacle.

Barbed Wire

The system for dispensing and tensioning of multiple strands of barbed wire is designed around a multiple-disc brake. The spools are keyed to sprockets which are braked by sprocket discs of the brake. The sprocket discs are separated by friction discs and the entire stack is spring-loaded. In setting up the equipment, the barbed wire spools are reeved so that each brake-sprocket disc is driven in a direction opposite to the adjacent discs, effectively equalizing the tension between strands. The arrangement allows up to four strands of barbed wire to be paid out smoothly and drawn with equal tension. Each strand is guided by especially designed pulleys.

Woven Wire

Woven wire is dispensed by unreeling from a vertical spindle, an adjustable band brake applying a slight tension to prevent the fencing from lying on the ground. As the wire pays out, it passes between the jaws of a self-adjusting, hydraulically operated clamp. When the wire is to be attached to posts, the clamp is actuated to grip the wire. The machine is driven slightly ahead to properly stretch the wire.

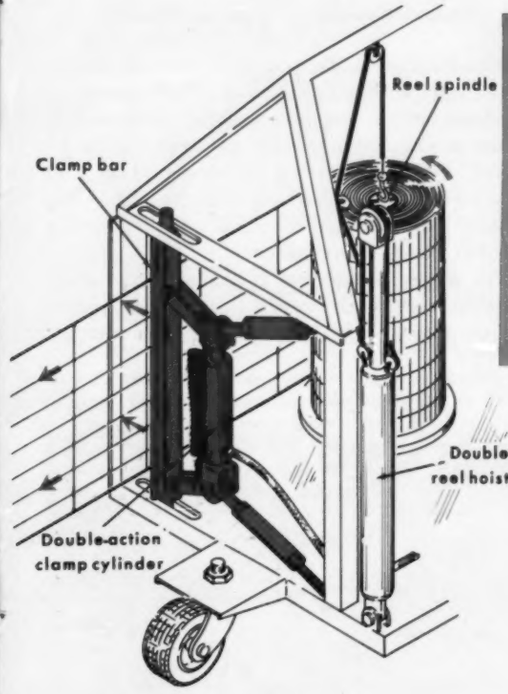
Operation

Normally, the machine is used in a one-pass operation, automatically paying out the wire as the machine moves ahead to the next post location. Only two men are required, one to drive the tractor and one to operate the machine. However, when used with a third man to bring up supplies, it realizes its greatest efficiency and is capable of erecting a mile of fence per day under ideal conditions.

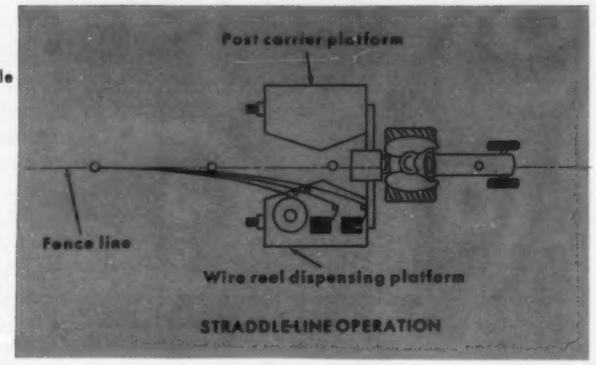
The machine was developed by United States Steel Corp. for the American Steel and Wire Div.

FENCE-ERECTION MACHINE is semi-mounted behind tractor and carries supply of posts and wire. Posts are driven by standard post driver mounted on tractor and driven by its power take-off. Hydraulic cylinders and levels mounted on post driver provide for rapid, plumbed post erection. Platform trailers carry wide-dispensing equipment and fencing supplies.

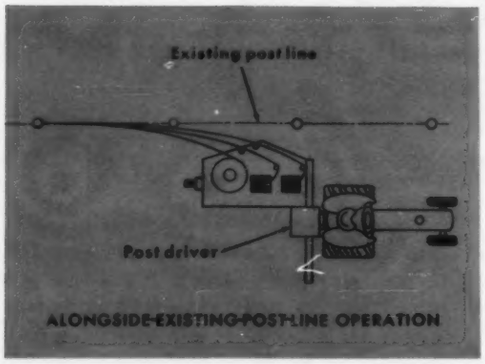
and Woven Wire in Fence-Building Machine



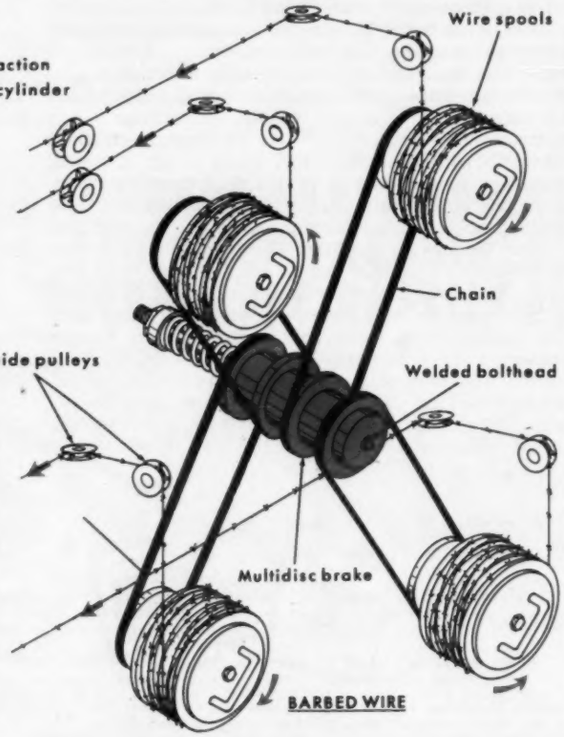
WOVEN WIRE



STRADDLE-LINE OPERATION



ALONGSIDE-EXISTING-POST-LINE OPERATION



BARBED WIRE

PLATFORMS are suspended independently by horizontal pipe hitch and are equipped with individual casters. Normally, they are assembled on either side of post driver for straddle-line operation; however, wire-dispensing trailer may be set up on one side of tractor for working along ditch, trees or existing line of fence posts. Multidisc brake equalizes tension of several strands of barbed wire. Spools are attached to spool holders by demountable end plates. Spool holders are braked by sprocket brake-discs, separated by discs of friction material. Strands are reeved so alternate sprockets rotate in opposite direction equalizing tensions of strands. Spring force is adjustable to allow tension adjustment. Guide pulleys are swivel-mounted on clamps which can be attached to frame as required. Woven wire fencing is unreeled from roll turning on vertical spindle. Tension is applied by moving tractor slightly ahead while hydraulic clamp grips wire. Removable spindle and builtin hydraulic hoist ease loading of woven reels.

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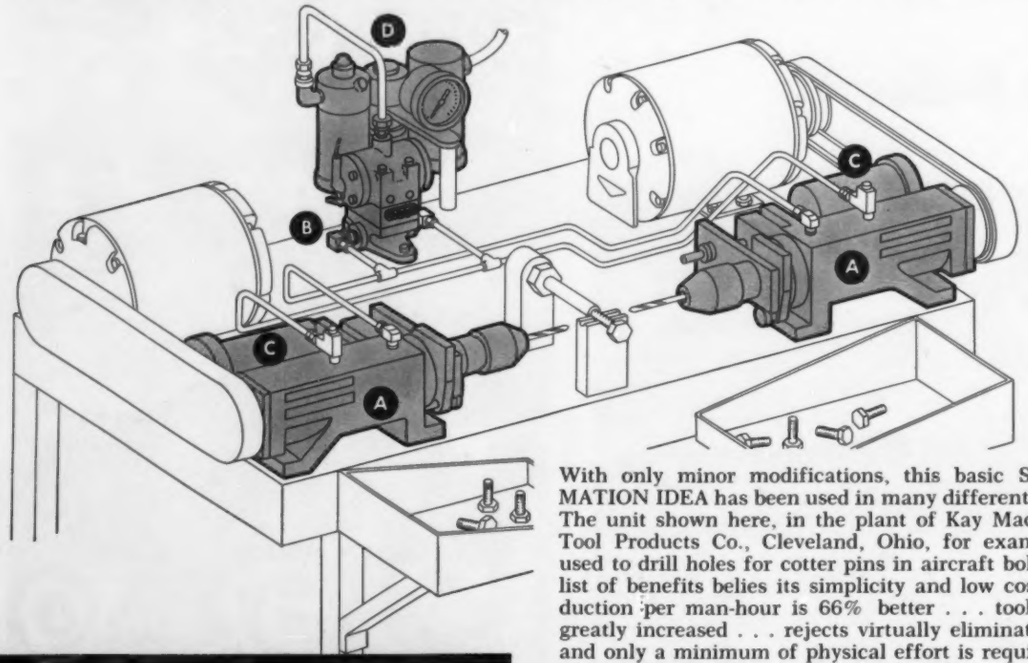

As shown in the photo above and "keyed" in the drawing, this shop-built drilling machine consists essentially of two low-cost, air-operated Bellows-Locke Model 22A Drill Units (A), a Bellows Electroaire® operating control valve (B), two Bellows Hydro-Checks® which provide smooth precision operation (C) and a Bellows Lubri-Air® Control Unit which cleans, regulates and lubricates the air supply (D). Not visible is the foot-operated control pedal.

697C-3

With only minor modifications, this basic SPOT-A-MATION IDEA has been used in many different plants. The unit shown here, in the plant of Kay Machine & Tool Products Co., Cleveland, Ohio, for example, is used to drill holes for cotter pins in aircraft bolts. The list of benefits belies its simplicity and low cost: production per man-hour is 66% better . . . tool life is greatly increased . . . rejects virtually eliminated . . . and only a minimum of physical effort is required for what formerly was a very fatiguing operation.

The machine is built around two compact interlocked Bellows-Locke Model 22A Drill Units — air operated, hydraulically controlled — mounted horizontally in opposed positions. Automatic feeding, positioning and ejection could be incorporated easily by the addition of other Bellows "Controlled-Air-Power" Devices. This SPOT-A-MATION IDEA can be readily adapted to perform a wide range of other operations, such as punching, forming, riveting, crimping, etc., by using such other Bellows work units as The Bellows Air Motor® in place of the Drill units.

This machine is typical of the ways cost-conscious men the world over are using Bellows "Controlled-Air-Power" Devices to secure faster, better, lower-cost production. Opportunities exist in your plant, too. Why not investigate — *today!*

THIS "SPOT-A-MATION IDEA" FILE IS YOURS ON REQUEST

Contains installation data, wiring diagrams and equipment lists for the "Spot-A-Mation" idea sketched above, as well as for scores of similar ideas you can use. Write Dept. DN-861, Bellows-Valvair, Akron 9, Ohio.

Bellows-Valvair

AKRON 9, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

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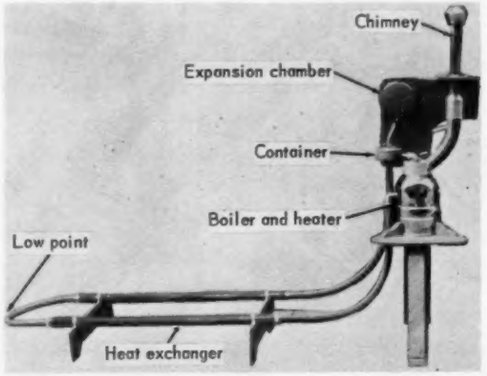
Steam Pulses Circulate Water Without Moving Parts

Volrath Holmboe, Correspondent in Sweden

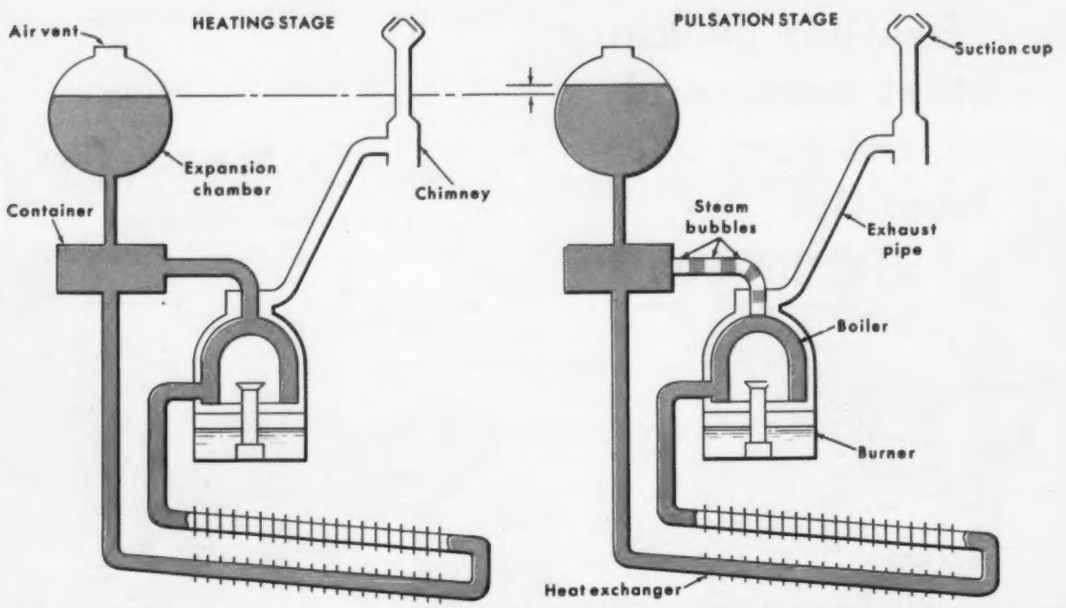
Steam bubbles acting as a series of pistons in a short vertical pipe replace a circulation pump in a closed circuit. The arrangement, which is free from moving parts, permits the boiler to be located well above the heat exchanger, in spite of the lower specific gravity of the hot water in the boiler. The principle is basically similar to that used in several coffee makers.

To achieve circulation, buoyancy of the steam bubbles has to overcome the difference in specific gravity between the water in the heat exchanger and the water in the boiler as well as the resistance in the system. If the resistance for some reason becomes too great, the boiler will run dry and the steam will escape through the air vent in the expansion chamber.

The principle is used in a heating system for small boats to permit the heat exchanger to be located along the floor underneath the berths. The use of an alcohol burner makes the heating system independent of the engine. Designated Ge-Ha, the heating system is marketed by the firm G. A. Ekstrom AB, Stockholm, Sweden.



COMBINED RESERVOIR AND EXPANSION CHAMBER with air vent forms highest point of system. A point toward which all pipe lines are sloping avoids air traps, which would set system out of function. Heater provides ample heating for 8-10-meter-long boat. Temperature at heat exchanger varies from 70-50C.



WORK CYCLE is intermittent with two stages: heating and pulsation. During heating stage, water is brought to boiling. During pulsation stage, steam bubbles formed in boiler push water up through vertical pipe. At the same time, cold water is sucked into boiler from heat exchanger which stops boiling. Process repeats every 30-60 sec depending on temperature and amount of incoming water. Water in container above boiler absorbs excess steam bubbles. Three-quarter-inch-dia pipe between boiler and container permits bubbles to fill nearly entire cross-section to provide pump effect. One-half-inch-dia pipe between container and expansion chamber is sufficiently small to prevent recirculation and excessive heating with evaporation of water in expansion chamber.

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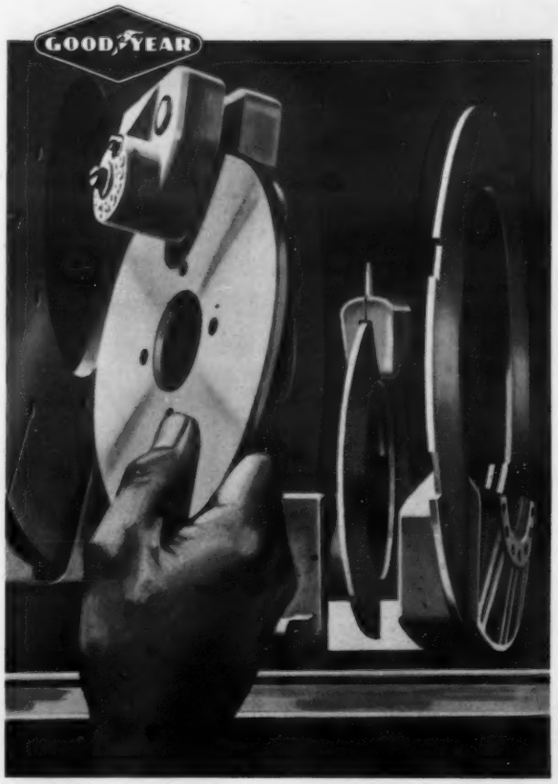

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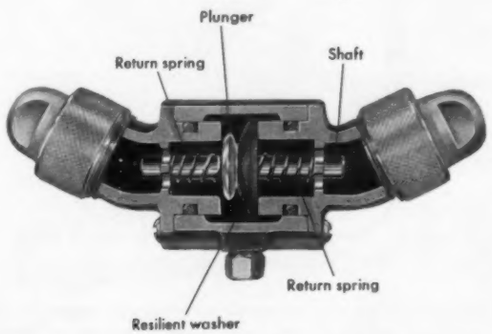
Washer 'Flips'

Lars. G. Soderholm, Midwest Editor



A pressure-responsive reversing valve makes use of a resilient seal washer that closes one of two outlet ports and simultaneously positions itself to close the opposite port at the next application of pressure. A rotatable core permits bypassing of the reversing mechanism so both valve outlets can be used together.

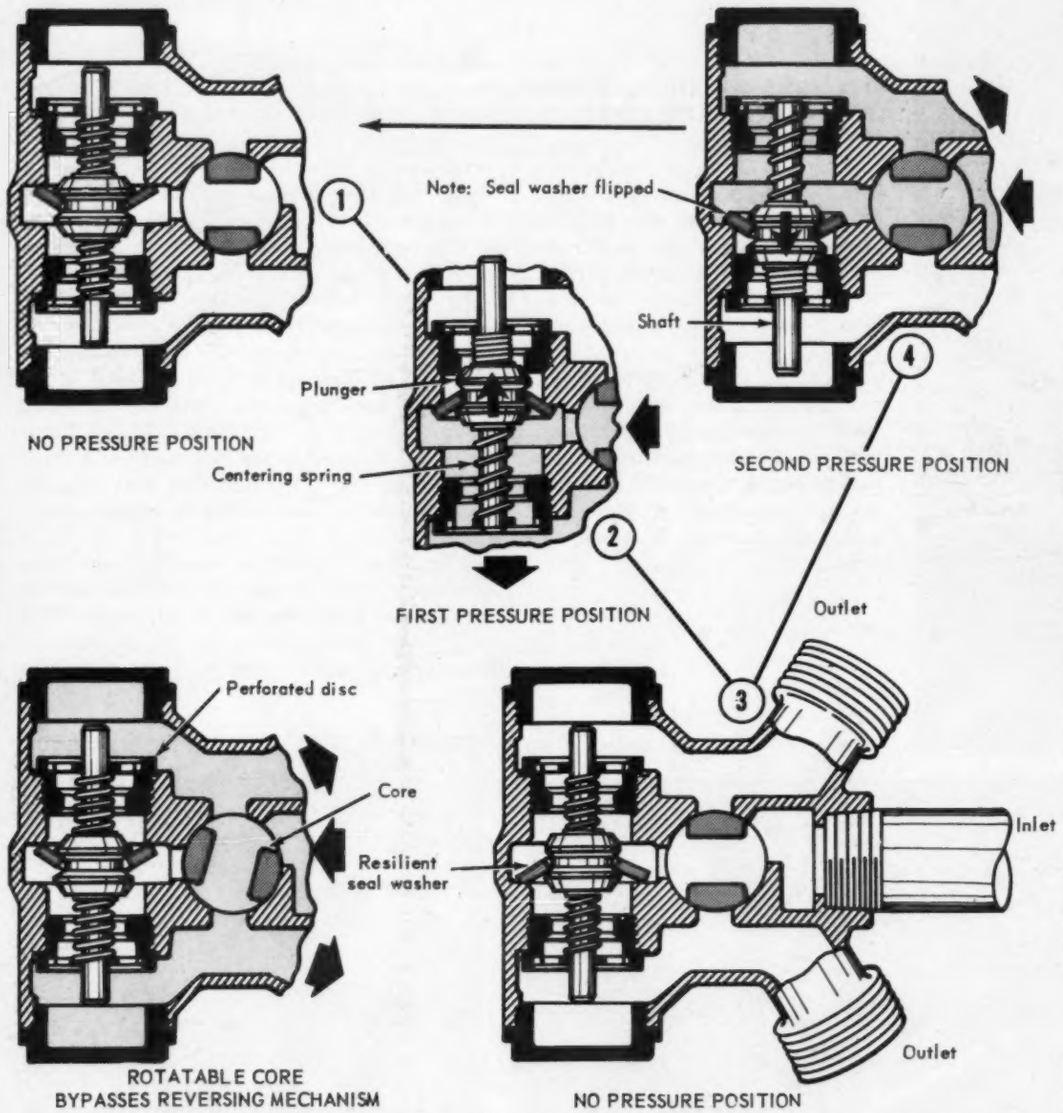
The reversing valve is used in applications where fluid flow from the valve is desired alternately in different directions. For every application of pressure the reversing valve selects, in turn, first one outlet and then the other. By using three valves, two on the outlets of the first valve, automatic alternate selection from four outlets is possible. With seven valves the selection is from eight outlets, and so on.

Inside each valve is a plunger mounted in the center of a short shaft. The shaft slides back and forth in the center of perforated discs located in the two outlets. While normally the plunger is located directly between the outlets by two centering springs, it can be pushed toward either one or the other of the outlets.

The plunger has a machined groove about its middle section that holds a resilient seal washer. Because the ID of the washer is less than the OD of the plunger groove, the washer is forced to assume a flared or conical shape. The direction of this flare is used to determine what outlet will be open to flow at the next application of pressure.

When pressure is admitted to the valve, the seal washer shifts toward the shoulder of the valve housing of the outlet port nearest the flare. This blocks the outlet and causes the plunger to move

to Select Alternate Outlet in Reversing Valve



ROTATABLE CORE BYPASSES REVERSING MECHANISM

NO PRESSURE POSITION

into the seat of the closed outlet. The movement of the plunger also "flips" the flared seal washer which, while sealing the closed passage, now also is pre-positioned to close the opposite port the next time pressure is applied

A rotatable core can be placed in the fluid passage leading to the reversing mechanism. When the core is turned through a handle on the valve exterior, the reversing mechanism is bypassed and fluid flows to both valve outlets at the same time. After being bypassed, the reversing assembly still remembers its last position and reverses itself automatically when returned to service.

The pressure-responsive reversing valve is normally provided in brass construction with either 3/4 inch NPT or 3/4 inch GHT connections. It was developed for and is manufactured by the Hanson Equipment Co., Beloit, Wis.

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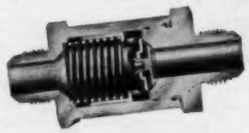
Mini-Valve Regular Size Valve

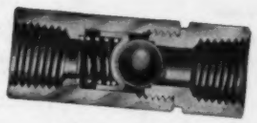
Save weight and space with Mini-Valves. They have same rated flow as regular size, but are only ¼ the size and weight. Good pressure drop characteristics. Temp. range –65° to plus 400°F. Operating pressure to 5000 psi. One-piece stainless steel body, in tube sizes 4 to 16 (¼" to 1" O.D.) Meets or exceeds requirements of MS MIL-V-25675. Port threading MS33514 flareless.



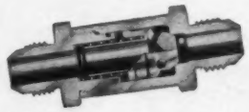
FREE-FLOW CHECKS

Extremely low pressure drop, with wide open flow. Molded elastomer seal and spherical seat prevent leakage at any pressure. Sizes ⅛" to 2" in brass and aluminum alloy up to 3000 psi, and stainless steel to 4000 psi. Opens at 2 psi. Temp. range –65° to 200°F. Pipe, internal straight thread and flared tube connections standard; MS33514 flareless available.

BALL CHECKS



Ruggedly constructed for intermittent non-shock hydraulic service up to 500 psi at temperatures –65° to 350°F. Sizes ⅛" to ¾". Brass, aluminum alloy, stainless steel. Pipe and flared tube connections.



HY-PRESSURE CHECKS

Built for continuous service in high velocity systems at pressures up to 5000 psi in steel and stainless steel, and 3000 psi in aluminum alloy. Low pressure drop. Metal-to-metal seal. Operating temperatures –65° to 250°F. Sizes ⅛" to 2", with pipe, internal straight thread and flared tube connections. MS33514 flareless available.

Distributors in principal cities coast to coast

RM REPUBLIC MANUFACTURING CO.

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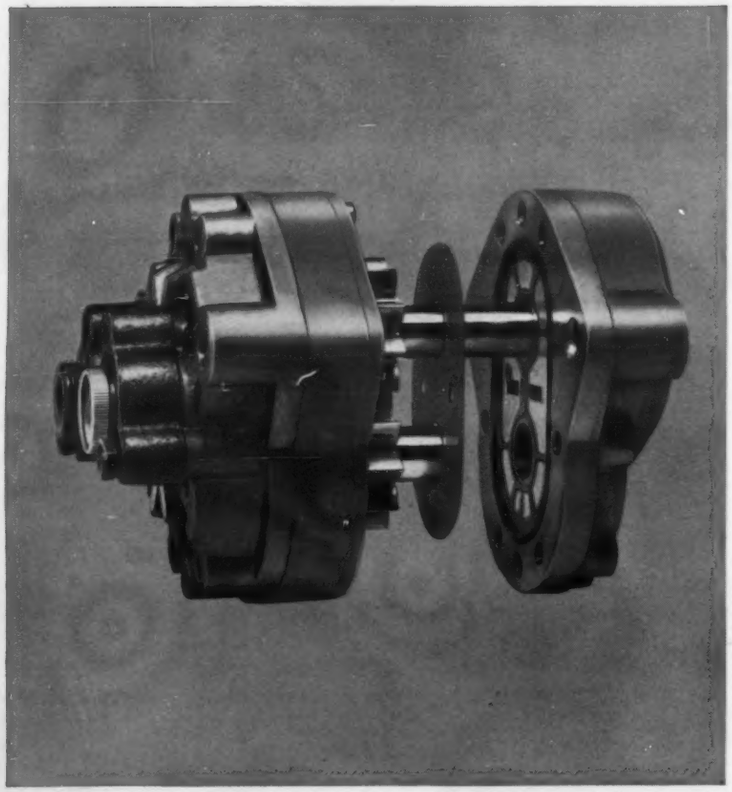
Circle 14 on Reader-Service Card for more information

F-M WEAR PLATE "RIDES HERD" ON TURBULENT PRESSURE



IN CESSNA'S NEW HYDRAULIC PUMP LINE, F-M WEAR PLATE DIAPHRAGMS KEEP FLUIDS IN LINE to deliver pressures up to 2000 psi for aircraft, farm and construction equipment, many other hydraulic applications. These wear plate diaphragms maintain positive contact with gears to assure high, uniform pressure. To provide a bearing surface for this job, Federal-Mogul applies a high-density bronze to steel by a special sintering process. F-M high-density bronze prevents fluid absorption, and it affords good lubricity, needed because some hydraulic fluids are poor lubricants. To further prevent the escape of hydraulic fluid, these F-M diaphragms are manufactured for a snug, close-tolerance fit in the pump housing.

THE COMPLETE LINE of products from Federal-Mogul Division includes sleeve bearings, bushings, spacers, thrust washers, as well as wear plates. Through the years, F-M has amassed a wealth of knowledge and experience . . . from constant research, from solving bearing design problems for all kinds of products. Our engineers are ready to put this know-how to work and tailor bearing products to your requirements . . . with top performance assured.

A DESIGN GUIDE provides valuable engineering data for designers on F-M thrust washers as well as wear plates. Also available is literature on sleeve bearings, bushings and spacers. For your copies, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11055 Shoemaker, Detroit 13, Michigan.

FEDERAL-MOGUL

sleeve bearings
bushings · spacers
thrust washers

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC.

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ID of Planet Gear

E. J. Stefanides, Central States Editor

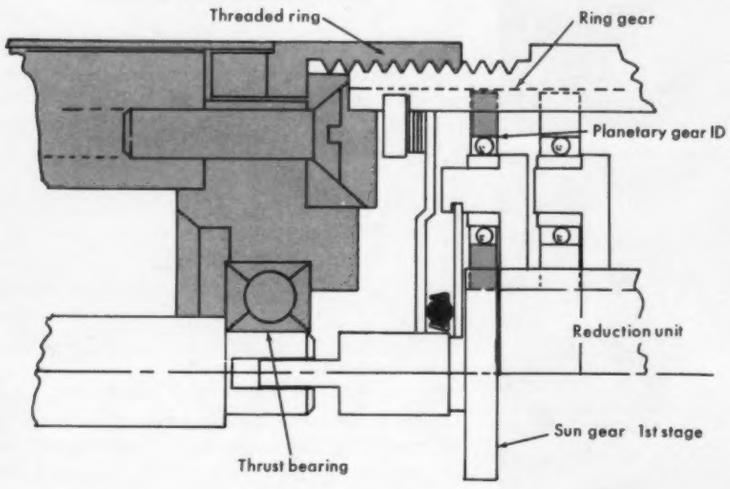
Antifriction ball or roller bearings are used at every bearing location in a line of miniature, multistage, planetary-geared reduction units. This has resulted in stage efficiencies of 90 percent or better and has enabled the designer to provide highly efficient torque multiplication in extremely small package sizes.

The complete line is designed in a modular manner around two models. The basic model is a 1-1/2-inch flange reducer which is supplied in one to four stages. Three different ratios are provided in the single-stage unit and various combinations of these three ratios are used in the multistage units to provide a total of 18 different ratios. The three- or four-stage 1-1/2-inch flange units also are used as the first stages of a three-inch flange, four- or five-stage unit, thus providing an additional 10 ratios for higher torque applications.

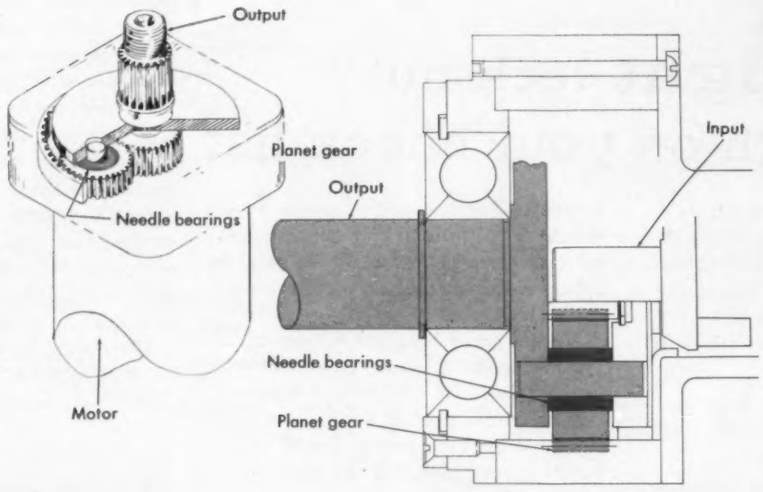
The design concept of applying antifriction bearings at every location required considerable ingenuity in execution, particularly in the 1-1/2-inch flange model where the entire planetary system must be contained within a 1-1/2-inch

MINIATURE GEAR-REDUCTION UNITS are designed for use with 1-1/2-inch dia d-c permanent-magnet motors of 1/30 and 1/45 hp. Two models provide total of 28 different reducers with gear ratios ranging from 1.87 to 5211. Output shaft of both models is equipped with integral AGMA-ASA standard 18-tooth splines.

Forms Outer Bearing Race in Miniature Gear Reducer



SECTION THROUGH SMALLER UNIT shows how planet gear ID is used as outer race of antifriction bearings. Thrust-bearing arrangement on input shaft prevents thrust from being transmitted to sun gear of first stage. Unit couples directly on end of motor by means of floating threaded ring on motor which screws onto OD threads of reduction unit. Alignment of motor and reduction unit is accomplished by round plate on motor end which fits closely in ID of planetary system ring gear.



SECTION THROUGH FOURTH STAGE of large flange unit shows how planet gears of this stage are mounted on shafts supported on each end. Gears are equipped with press-in roller bearings. Input to this stage is output of three- or four-stage unit.

circle. The space limitation problem was solved by using the ID of the hardened, sintered-alloy planet gears as the outer race of the antifriction bearing. The inner race is pressed on cantilever stub shafts which are an integral part of the sintered planet carriers. In the first two stages, ball bearings are used while needle bearings are used in the third stage.

Space restrictions are not as stringent in the fourth stage of the larger unit and more conventional press-in type roller bearings are used in the planet gears, along with a different design planet carrier which supports the planet shafts on both ends.

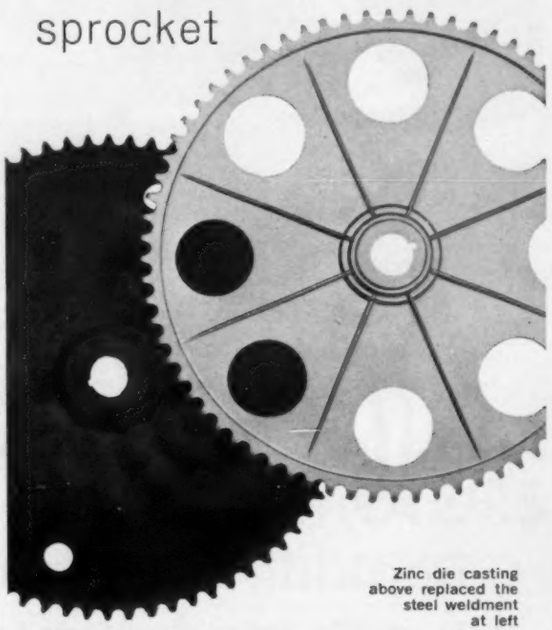
This line of gear reducers is intended for aerospace and military electronic applications and is presently being used with 1-1/2-inch dia d-c permanent-magnet motors. When used with a 1/30-hp motor, the highest capacity unit of the line is capable of multiplying 5 oz-in input torque at 6670 rpm to 550 lb-in of continuous output torque at 1.28 rpm.

The reducers are designed and manufactured by Globe Industries, Inc., Dayton, Ohio, who also manufacture the motors for which they are designed.

ADVANCE put

teeth *

into reducing the cost of this sprocket



Zinc die casting above replaced the steel weldment at left

* By "teeth" we mean Advance engineers bit deep into the cost of the 12-inch steel weldment sprocket shown above and came up with a **saving of better than 50%** in converting it to a zinc alloy die casting.

The sprocket drives the rotating drum of an industrial clothes dryer. Both pitch and O.D. are held to .010 tolerance. Interchangeable cores and inserts readily produce this sprocket with ¾ or 1 inch bore.

Whether it's a conversion, or a die casting of completely new design, putting "teeth" into a die casting cost problem is what Advance engineers like most to do.

Why not send your next print to Advance for a quotation? Ask for the Advance folder "Your Doorway to Certified Zinc and Aluminum Die Castings".

These symbols are your assurance of highest quality control of zinc and aluminum alloys under ADCI standards.

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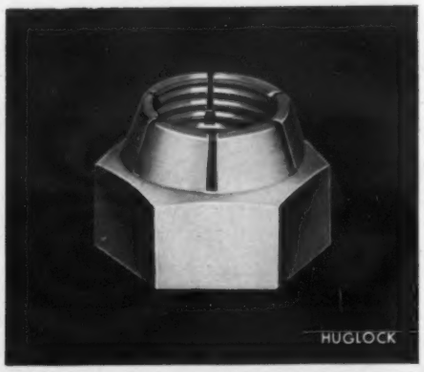
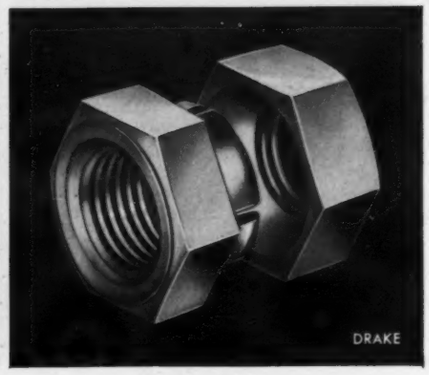
NAT'S
quick facts
about
Fasteners...





Looking for the **right** lock nut?
Put these four high on your check list

By taking an early look at these National all-metal lock nuts, you may often be able to make quick work of finding the locking member that best meets the requirement of your particular job.

Once over lightly, here are the advantages they offer you.

MARSDEN—For minimum cost and average conditions. Free-running until seated. One-piece, fully re-usable.

HUGLOCK—For use under adverse conditions. Locks without seating. One-piece design, and fully re-usable.

CONELOK—For applications requiring high-fatigue life, as assured by closed stress paths in Conelok's locking sections. Locks without seating. One-piece design, and fully re-usable.

DRAKE—For use under severe stress, shock or vibration. Free-running until seated, or can be locked at any point by using two wrenches. Two-piece design, and fully re-usable.

Take a good look at all four, and at the advantages they may be able to offer in your product assemblies. You may not be thinking of an application right now, but get the literature* and keep it handy in your files, just in case.

*There's a folder on the Conelok, and a booklet on the others. Write for your copies.

National PRODUCTS

The National Screw & Mfg. Company • Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

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IDEAS...MECHANICAL

Brake Locks Bearing Screw

Lars G. Soderholm, Midwest Editor

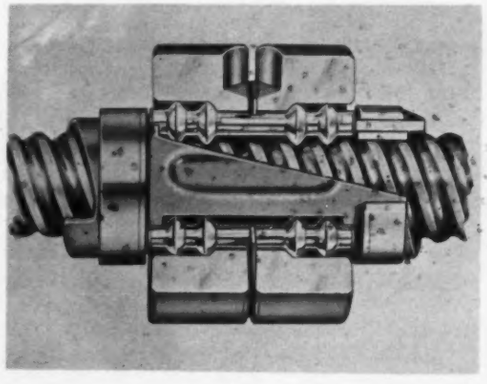
An infinite positioning and positive lock mechanism for reclining-seat applications uses a bearing screw with a spring-loaded brake disc. The seat-back cam-release assembly disengages the brake which permits free rotation of the screw assembly as the seat back reclines. Release of the cam provides positive locking in any position.

The linear positioning mechanism uses a Roton bearing screw to allow straight line travel as far as the length of the screw will allow. By incorporating a brake in the rotating screw portion of the assembly, the mechanism can be locked at any position.

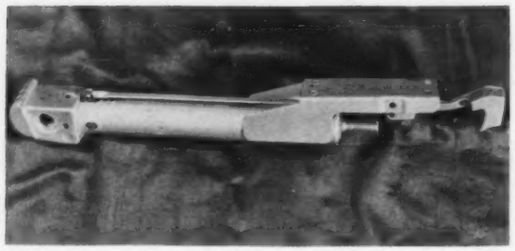
As the seat is reclined, the nonrotating unit portion of the screw assembly moves backward in the mounting tube against a counterbalancing compression spring. This spring automatically returns the unit (the seat back) to its original position when the brake seat release is pressed. To provide a "dress-up" feature, this mechanism can be returned manually to its original position since pressure opposite the reclining direction will cause the brake discs to separate and the seat back will return to its forward position.

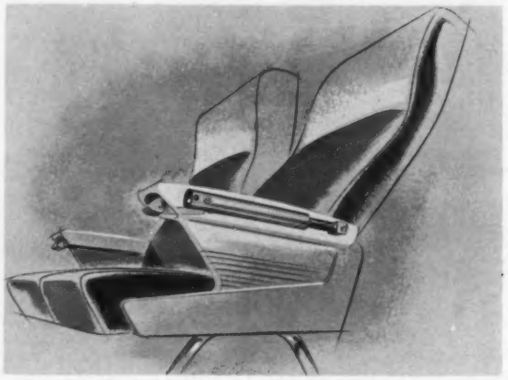
The mechanical liner positioning and lock mechanism was made to offer competition with hydraulic systems that are used in reclining seat service. The manufacturer claims this unit will offer extended service life with little or no maintenance required. Standard mechanisms offer the optimum in economic considerations.

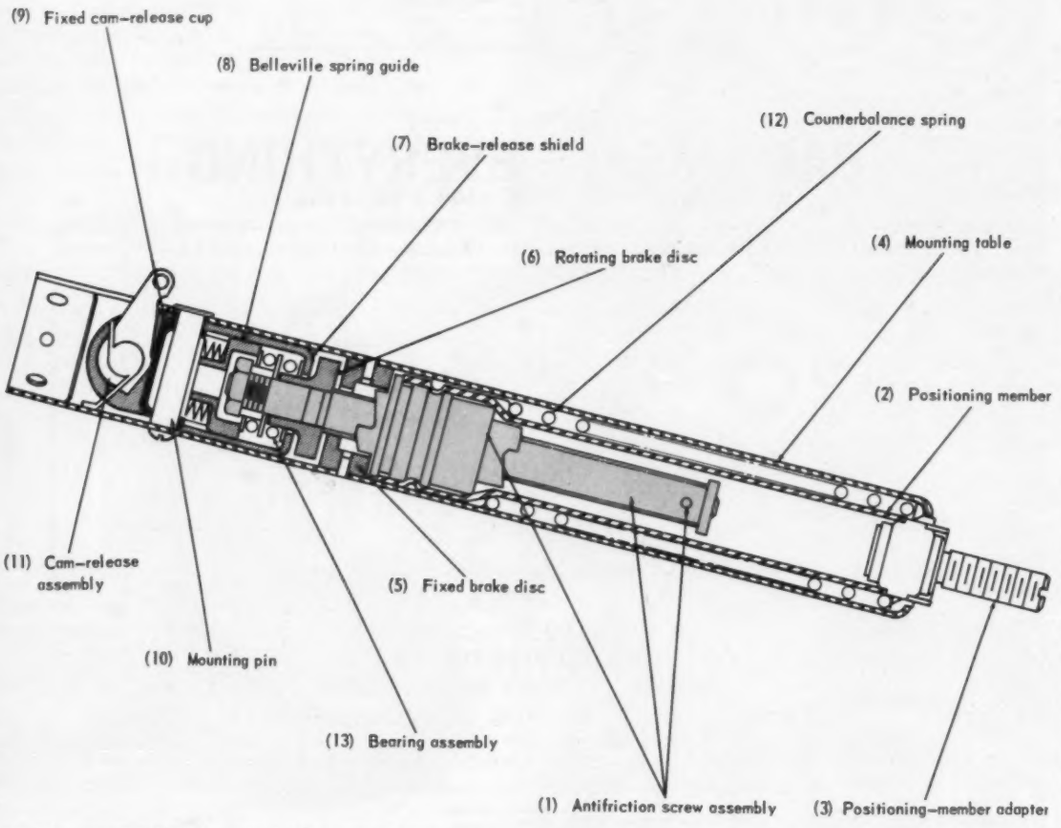
The Roton Linear Positioning Lock is manufactured by The Roton Products Div., The Anderson Co., Gary, Ind.



to Hold Reclining-Seat Position







LINEAR POSITIONING AND LOCK MECHANISM operating sequence: Cam release (11) when pulled against fixed cam-release cup (9) moves brake-release shield (7) forward, compressing Belleville spring (8). This pulls rotating brake disc (6) away from fixed brake disc (5) allowing bearing screw (1) to rotate as positioning member (2) is extended. When bearing screw rotates, bearing unit travels down mounting tube (4), compressing counterbalance spring.

Specify Air Power!

STOCKED FOR IMMEDIATE SHIPMENT

Use variable-speed, explosion-proof

GAST AIR MOTORS

Need a compact, low-cost motor for original equipment or plant use applications? *Air may be your answer . . .* using one of these efficient Gast rotary-vane Air Motors. Look at the special advantages they offer you:

1. They're explosion-proof — no sparks, no danger!
2. Low initial cost compared to other motors.
3. Speed variable with simple valve control.
4. Can't burn out if overloaded or stalled.
5. Reversible rotation optional on some models.
6. Rotor vanes take up their own wear.
7. Quickly attached to plant air lines.
8. Amazingly light, compact for h.p. delivered.
9. Ball-bearing; almost service-free design.
10. Mechanically simple, neat in appearance.

Gast Air Motors are supplied as original equipment on pneumatic hoists, mixers for paint and chemicals, fans, blowers, fuel hose-reel rewinders, liquid pumps, spooling machines and a host of other products. Used in explosive atmospheres and in "hot" locations to 250° F.

Model No.	1AM	2AM	4AM	6AM	8AM	16AM
H.P. at 90 P.S.I., 2000 RPM	0.13	0.57	1.1	2.0	4.0	7.0
Weight, lbs.	1½	5½	8	17	25	65

For complete performance data, write for Air Motor Bulletins. Specify models that interest you.

THEY'LL DRIVE EQUIPMENT 4 WAYS:

AIR MOTORS • VACUUM PUMPS • COMPRESSORS

GAST MANUFACTURING CORP
P.O. BOX 117-G, BENTON HARBOR, MICHIGAN

Circle 18 on Reader-Service Card for more information

CIRCLE SEAL GAUGE PROTECTOR

SERIES 1100

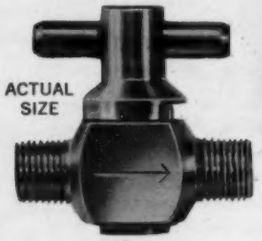
A safety shield for gauges and personnel, the Circle Seal Gauge Protector is designed for pneumatic or other gas systems as well as liquid service. Use of contact rather than sliding seals overcomes O-Ring breakaway friction problems associated with piston type units. Automatic cut-out when system pressure exceeds gauge limit... automatic cut-in when system pressure returns to normal maximum. In gas systems, surge or shock waves will close valve momentarily to reduce shock to gauge elements. Where gauges are cascaded, Gauge Protector automatically cuts out lower pressure gauges... cuts them in as system pressure falls.

PREVENTS COSTLY DAMAGE ... AUTOMATIC GAUGE CUT-OUT

From 15 to 2400 psi... —100° to 500°F. Wide range of cut-out pressure settings. Available in brass or 303 stainless.

Military Service:
JAMES, POND & CLARK, INC.
Industrial Service:
CIRCLE SEAL PRODUCTS CO., INC.
2181 East Foothill Blvd., Pasadena, Calif.

CIRCLE SEAL precision valves



SERIES 9500

CIRCLE SEAL MINIATURE PLUG VALVE

Miniaturized at no sacrifice in quality, the Circle Seal 9500 Series is ideal for application in instrumentation, inert gas test stands, hydraulic clamps, jacks, etc. The convenient "T" handle with 90° actuation provides effortless opening and closing. The handle is color coded for various gases and liquid service requirements. The visual indication provided by the "T" handle can be used as a metering device by turning the handle various degrees from full-on to full-off. "O"-Ring seals virtually eliminate wear. When required, simple repair is effected by replacing three "O"-Rings without removing valve from the line.

ABSOLUTELY LEAKPROOF ... EFFORTLESS CONTROL

Positive sealing from high vacuum to 2000 psi. Male or female connections in ⅛" or ¼" sizes. Brass or 303 stainless.

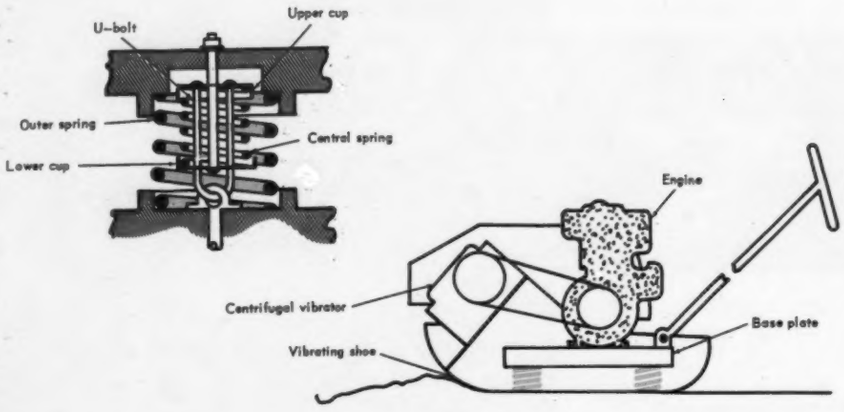
Military Service:
JAMES, POND & CLARK, INC.
Industrial Service:
CIRCLE SEAL PRODUCTS CO., INC.
2181 East Foothill Blvd., Pasadena, Calif.

CIRCLE SEAL precision valves

Circle 19 on Reader-Service Card for more information

Counter-Acting Concentric Springs

Celestino O. Lubatti, Italian Editor

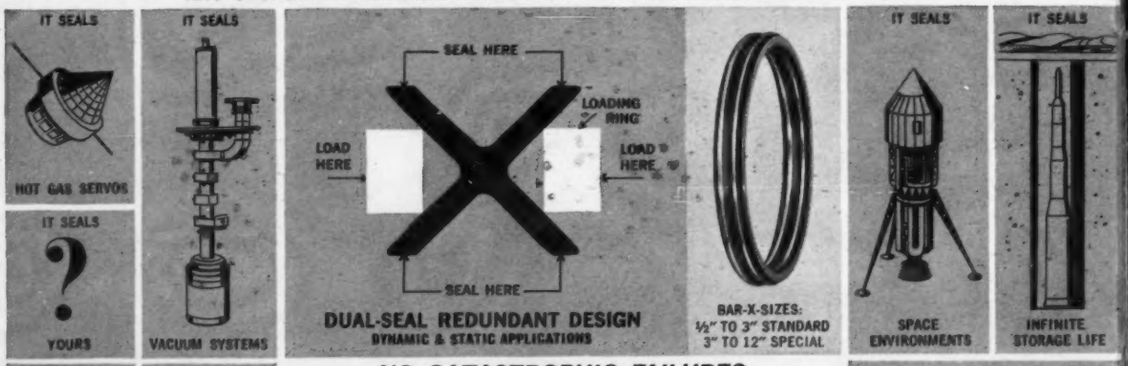


UPPER RETAINER CUP is connected to vibrating shoe by linked U-bolt. This allows small side deflection of springs to absorb side forces that otherwise may rapidly cause fatigue failure.

BAR-X® SEALS EVERYTHING

AT TEMPERATURES FROM —400° F TO +1500° F!

ANY FLUID—GAS—FUELS—WATER—LIQUID METALS—CRYOGENIC FLUIDS—CORROSIVE FLUIDS
ANY SYSTEM—HYDRAULIC—PNEUMATIC—VACUUM—CRYOGENIC—NUCLEAR



NO CATASTROPHIC FAILURES
INFINITE STORAGE LIFE
UNPRECEDENTED SERVICE LIFE

Eliminates critical downtime ■ Very high and very low pressure ■ Easy, foolproof installation (not a mechanism) ■ All-metal—non-contaminating ■ Stable, symmetrical design

WRITE TODAY FOR THE FULL STORY! SALES ENGINEERS IN PRINCIPAL CITIES.

Wiggins

E. B. WIGGINS OIL TOOL CO., INC., Dept. C1
3424 E. Olympic Blvd., Los Angeles 23, Calif.
TWX 1403U, Phone AN 9-0181

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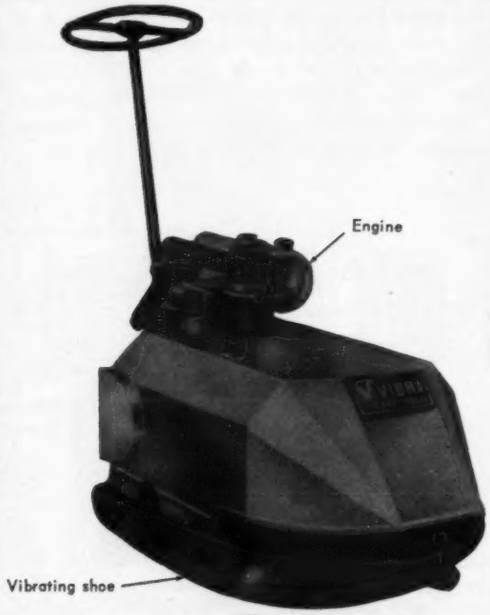
Form Compact Suspension

Concentric springs, working against each other, minimize the height of the engine suspension in a power tamper. Center of gravity of the suspended unit is lowered considerably and dynamic loads are balanced without use of heavy counterweights.

The outer spring spanning the distance between vibrating shoe and engine base plate bears the weight of the engine and allied parts. A weaker central spring is clamped between retainer cups and is connected respectively to base plate and vibrating shoe. Connection bolts traverse the cups and convert rebound of outer spring into compression of the central spring.

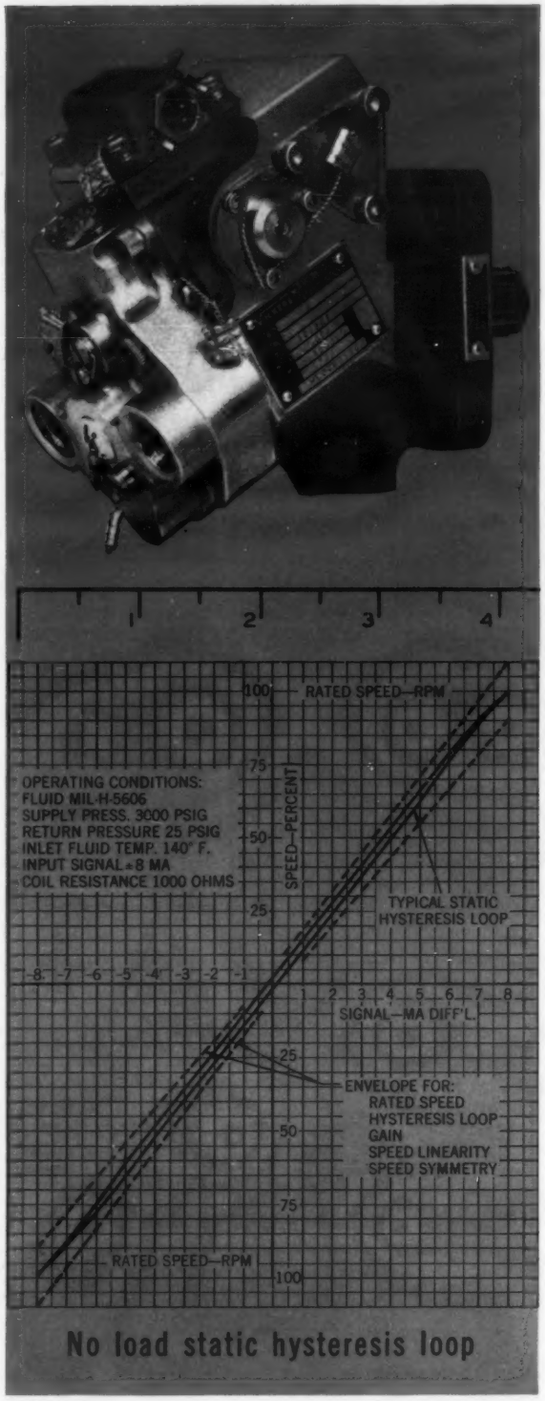
The four-point suspension eliminates wide-amplitude oscillations and/or large relative movement between engine and vibrating shoe. Suspension rigidity can be set by adjusting connection bolts on the base plate. These establish preload on the double-acting springs.

This power tamper is designated "Viter", and is produced by Vibra S.C.V., Milan, Italy. It was exhibited at the Milan Fair.



CENTRIFUGAL VIBRATOR driven by 6-hp engine produces 1500 blows per minute. Double-acting suspension springs prevent waving movement, permit 10-15 meters per minute advancement speed with 50-60 cm tamping depth.

Performance Guaranteed by Integrated Hydraulic Servo-Motor



Completely new package developed for missile, aircraft and ground support control systems cuts breakaway torque sharply and reduces minimum smooth output speed.

This integrated package consisting of a servo valve and a specially designed, high case pressure hydraulic motor sets a new performance standard for electro-hydraulic servo-motors. Applications requiring continuous, precise output speeds in either or both directions over the entire range are ideally suited to this design. (see chart at left)

Your system requirements will be met precisely with this thoroughly tested package whose basic elements (hydraulic motor and servo valve) have been blended into a compatible operating control-actuator. This condition can seldom be attained when elements provided by two or more manufacturers must be matched. Compared with conventional manifolded components, the integrated Vickers package offers these specific advantages:

Unique Motor Design—High case pressure design eliminates internal axial forces and permits an optimum standby efficiency.

Lower Breakaway Torque—When compared with motors manifolded to servo valves, starting or breakaway torque is reduced by a factor of 8.

Lower Smooth Speed—Minimum smooth speed obtainable is reduced by factor of 5.

Reduced Size and Weight—Weight reduced by 20%; size by 30%.

High Reliability—Contamination can't be introduced during field assembly. Elimination of tube ports, fittings, and bolt-together components further reduces potential problem areas.

High Response—Results directly from low volume of oil under compression.

More Filter Capacity—Control flow to servo valve is filtered by large, self-cleaning, 15 micron nominal filter.

More data is available in Bulletin A 5256. Write for your copy today.

9570

AERO HYDRAULICS DIVISION
VICKERS INCORPORATED
DETROIT 32, MICHIGAN
TORRANCE, CALIFORNIA
division of SPERRY RAND CORPORATION

PROGRAMMED POWER IN: FLUID TRANSFER • POWER TRANSMISSION • ENERGY CONVERSION

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IF YOU CAN'T FIND A PUMP HERE FOR YOUR JOB

WE'LL ENGINEER AND BUILD TO SUIT YOUR NEED

Vertical pump with threaded connections and extra long shaft for deep wet pit operation.

Close-coupled, sidewall mounted Motorpump with mechanical seal—also available with dual discharge.

Long shaft, sidewall mounted Motorpump without seal—also available with dual discharge.

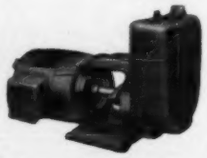
Vertical immersion, long shaft Motorpump without seal—with threaded vertical discharge.

Vertical immersion, long shaft Motorpump without seal—with threaded side discharge.

Flange-mounted cradle pump to meet JIC standards—has mechanical seal—also available with dual discharge.

Compact Motorpump with mechanical seal and threaded connections.

Compact Motorpump with packed box or mechanical seal and flanged connections.



Close-coupled self-priming Motorpump—also available in cradle-mounted type.

Vertical pump with flanged connections and extra long shaft for deep wet pit operation.

Cradle-mounted pump with threaded connections.

Four-stage pump for high heads—threaded connections.

Two-stage pump for high head—cradle-mounted units also available.

Cradle-mounted pumps with flanged connections.

There are pump specialists working out of our branch offices and every major city. Contact them or write direct to our New York headquarters.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

over a century **IR** *of pump progress*

from the leading manufacturer . . .

276A9

Circle 22 on Reader-Service Card for more information

Automatic Air Filter

Paul R. Taylor, Associate Editor

Air is whirled centrifugally as it enters a piston-operated filter, precipitating the moisture and contaminates in a lower sump, automatically draining any foreign particles.

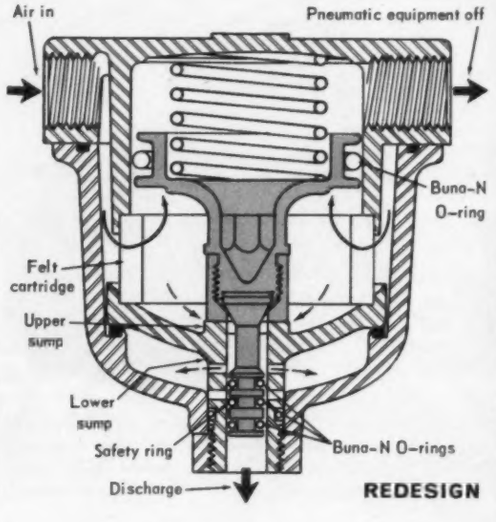
When air-operated equipment is off, air pressure forces the piston down, closing the "out" port and the lower sump is sealed from atmosphere.

Moisture accumulated from the previous "on" cycle is transferred from the upper sump to the lower by air pressure. "In the "on" cycle, moisture collects in the upper sump and the cleaned air raises the piston. Raising of this piston opens the lower sump to atmosphere, and moisture accumulated from the previous step is expelled in fog form.

A large O-ring of Buna-N slips free within an oversized groove around the piston, performing more than 3,000,000 cycles of service without failure to filter water and dirt as small as 5 microns.

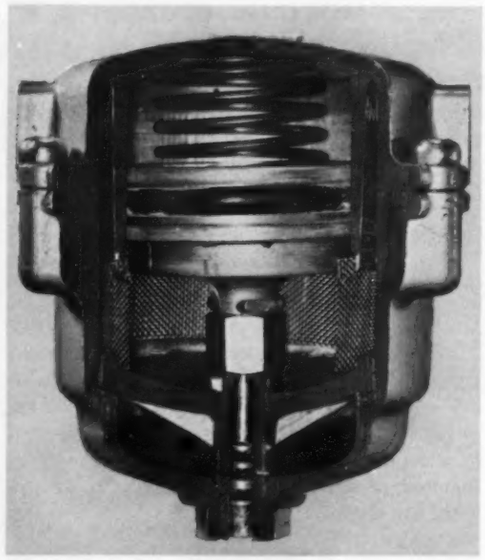
Three small O-rings (Buna-N) on the piston rod perform the transfer valving cycle between the lower and upper sumps. The center ring, of the three, provides a safety margin if the outer rings should fail. It would take hundreds of cycles to expel 1 cfm of air in this draining method.

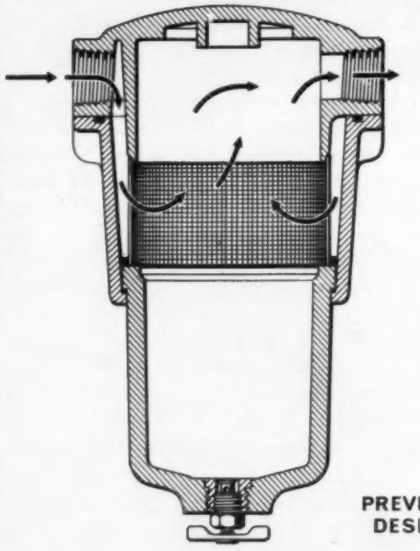
Miniaturized Model 1403 is a design development of Wilkerson Corp., Englewood, Colo.



REDESIGN

Performs Three Million Cycles





PREVIOUS DESIGN

PISTON IS DOWN, when air tool is off, and lower sump is sealed from atmosphere. Moisture accumulated is forced to transfer from upper sump to lower by air pressure. Incoming air in "on" position is baffled downward and whirled centrifugally as moisture and contaminates are precipitated. Foreign particles are trapped by element keeping them away from drain valve. Impregnated felt filters particles as small as 5 microns.

TEMPERATURE EXTREMES CREATE A DESIGN PROBLEM?

Du Pont coated fabrics made with silicones may help you solve it

Du Pont Fairprene® fabrics coated with silicones (polysiloxane polymers) offer a wide range of application possibilities in product design and improvement. Note these outstanding properties:

- They remain flexible even in sub-zero temperatures down to -65°F. . . . yet resist temperatures as high as 450°F.
- They resist oxidation, ozone, and corona . . . properties that add to their value in the electrical insulating field.
- Exceptional anti-stick qualities.
- Excellent electrical resistance and a dielectric strength of 500 VPM or better.
- Silicone rubber sheets are also ideal for gasketing materials in high- and low-temperature applications.
- They're strong and flexible.
- Resist oil and abrasion.
- Du Pont "Fairprene"-coated fabrics offer almost unlimited properties to help solve design problems. Fabrics of "Dacron"*, "Teflon"**, glass and other substrates are available with elastomeric coatings 38" wide and in thicknesses ranging from 1/64" to 1/8".

If you have a design problem, send coupon below for technical literature and samples of these fabrics. Du Pont has had wide experience in the development of coated fabrics for many applications, and stands ready to work with manufacturers in formulating coated fabrics or sheet stocks to meet specific requirements.

*"Dacron" is Du Pont's registered trademark for its polyester fiber.
**"Teflon" is Du Pont's registered trademark for its tetrafluoroethylene.

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DU PONT
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E. I. du Pont de Nemours & Co. (Inc.)
Fabric Trade Products, Dept. DN 1-8
Wilmington 98, Delaware

Please send literature on "Fairprene" fabrics coated with silicones.

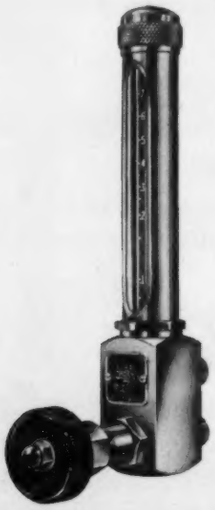
Name_____
Position_____
Company_____
Address_____
City_____ Zone_____ State_____

Circle 23 on Reader-Service Card for more information

HOKE Flow Sheet 6

HOKE REPORTS ON FLUID CONTROL

MEASURING, METERING AND DO-IT-YOURSELF



FLOW WATCHING FOR FUN AND PROFIT

(Follow the bouncing ball)

After making flo-gages for longer than we'd like to remember, we've come to realize that there's no one simple answer to the problems of flow measurement. Rather than try to solve everyone's problems at once, we've concentrated our efforts in the low, but delicate, flow ranges.

The variable area principle (the ball float in tapered tube bit) is nothing new, and we haven't done much to advance science here. But what we have done is to build some direct reading flo-gages that provide pretty accurate pictures of the downstream activities of some of your favorite gases. Depending on the gas you're using, we've made units with maximum ranges from 0.7 liters per minute up to 44 cubic feet per hour, and we've even built a needle valve into one unit for fussy flow watchers.

Serious hydrodynamicists (flow watchers, to you) will be happy to hear that they can get Hoke flo-gages in straight, angle and panel mounting models.

For a guide to flow-watching, make your mark in the box on the right.

One good turn deserves another, and it takes twenty to move the stem of the Hoke 280 Series metering valve from the closed to the full open position — a total of 9/16". And in case you lose count (or can't count) we can supply it with a vernier handle that shows turns and fractions of turns for accurate re-set.

What you're moving when you twirl the wheel on this bar stock needle valve is really a needle. It has an 8° included angle and seats in either a .062 or .125 orifice, so you can see it's possible to turn down to a pretty accurate trickle. If an 8° included angle will still not give you the control you want, we've turned stems that read out to a 1° included angle.

Now, here's a real stopper—a Teflon seat. In this modification, the needle is spring-loaded so that it can't gall, or be scored. And it's backed by a Teflon seat for positive shut-off. This seat bottoms on a raised orifice in the valve body and can be used to hold pressures up to 3000 psi. Vacuum's a snap, too.

If these facts leave you still unmoved, we've got a few more gems to dazzle you with. For instance, you can use these valves to temperatures up to 450°F. And you can choose from brass or 316 stainless steel.

And if you're one of those people who must be different, why not build one yourself. It's easy and you can do it by reading our 280 Series Data Sheet. All you need is a screw machine, turret lathe, milling machine and a few other easily acquired gadgets. However, if things don't work out too well, you can still get them from us.

To be really knowledgeable in the field of fine metering, all you have to do is read the facts in the Data Sheet. A check in the 280 box will bring you instant information.

'61 PRODUCT PARADE

You'd be surprised at some of the screwball ways our valves have been used (to decided advantage, of course). Hoke distributors are armed to their maxillary third molars with this method madness and will redesign your systems with new Hoke products at the drop of a postcard. Check the PRODUCT PARADE Box.

Hoke's Performance Guarantee—*Every* Valve *Leak*-Tested!

HOKE INCORPORATED
89 Piermont Road, Cresskill, N. J.

Send me complete information on the Hoke products checked below:

- ☐ 280 Series Metering Valves
- ☐ Flo-gages
- ☐ '61 Product Parade
- ☐ Complete Catalog GC 960

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

SEE OUR CATALOG IN SWEETS PRODUCT DESIGN FILE

Circle 24 on Reader-Service Card for more information

Redesign of Water Meter

Ronald W. E. Martin, British Editor

A redesigned meter for measuring domestic water flow uses a compact sealed counter that contains a simple reduction gear. The counter consists of a transparent plastic case in which the number rollers and change pinions are totally immersed in a liquid. Driven directly from the working chamber of the meter, the counter unit eliminates use of elaborate gear trains used in previous design.

The end cover of the case is cemented in position and the counter input drive passes through a synthetic rubber O-ring gland. A mixture of water and glycerine used to fill the case acts both as a lubricant and corrision inhibitor.

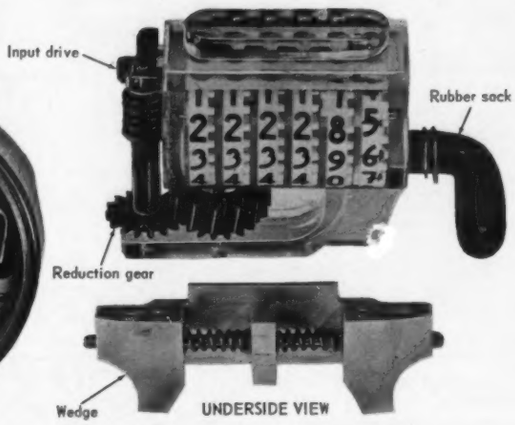
A difficulty of using this plastic type of construction for the counter case is the effect of pressure differences occurring across its main sections. This may result from changes in temperature (causing a volumetric change in the filling liquid) or in hydraulic line pressure. The problem is solved by using a partially deflated rubber sack attached to one end of the case.

Intended as an easily replaceable unit, the counter assembly is held in position by a simple spring-loaded double wedge. The wedge locates on two raised ribs in the meter housing and, by its wedging action, pushes the meter up onto its sealing gasket. Additional loading is provided by the meter internal hydraulic pressure which also increases the loading on the gasket.

A further feature of the meter design is that the conventional type working chamber has its axis in line with the pipeline direction of flow. This "straight-through" principle reduces changes in fluid-flow direction and thus minimizes hydraulic loss caused by changes both in direction and velocity of flow through meter body.

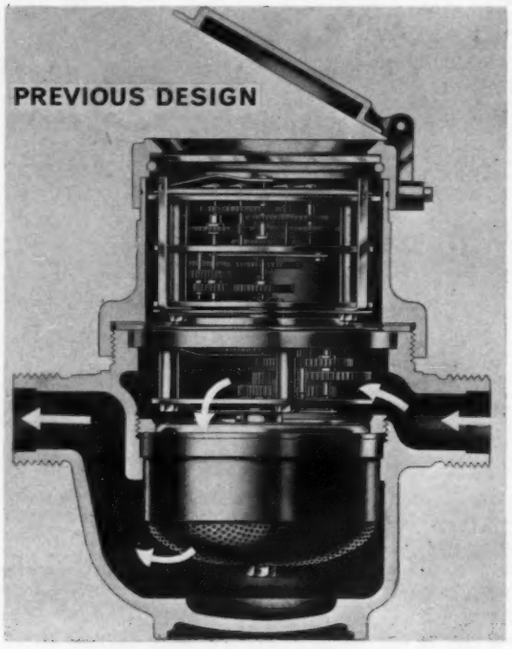
The counter unit used in this water meter is manufactured by George Kent, Ltd., Luton, England, and is patented by the company.

Reduces Number of Working Parts

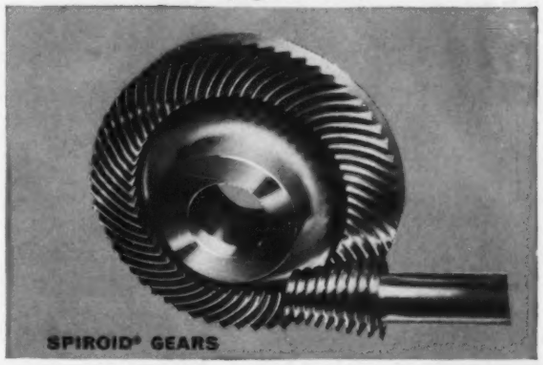


ROTARY MOVEMENT, as result of oscillatory motion of piston in measuring chamber, is transferred to straight-reading counter by simple worm and worm-wheel drive. All gears and shafts are molded in graphited nylon to minimize friction and eliminate corrosion. Counter is located by means of thick protruding section which fits in slot in upper half of meter housing. This section also provides counter window which is under hydraulic line pressure. Automatic pressure compensation provided by rubber sack means that counter input gland (used to retain filling liquid) is not subjected to pressure differences.

SPRING-LOADED WEDGE positions counter and reduction unit in upper half of meter housing.



From Illinois Tool Works' unique family of gears



new gear economies
with new gear efficiencies

Shown here are typical examples of outstanding developments in right-angle gearing introduced by Illinois Tool Works. Pictured above is a Spiroid gear, the first major advancement in gearing in thirty years.

SPIROID® GEARS do the same job as worm gears with this notable exception: they do it more economically and more efficiently in less space. They are recommended for application in the field of medium to high-ratio right-angle gearing. For maximum economy they may be sintered, molded or cast in metal or plastic; however, even hardened steel Spiroid gears for maximum power transmission are manufactured more cheaply than worm gears.

PLANOID® GEARS are low-ratio gears competitive with bevel and hypoid gears in efficiency and performance, but are manufactured at lower cost.

HELICON® GEARS bring even greater production economy to high quantity applications than is possible with face, bevel or worm gears.

Send today for these new gear booklets Free booklets are available giving complete information on the design, manufacture, applications and advantages of each of these gears. Request your copies today.

Spiroid® gears

SPIROID DIVISION OF ILLINOIS TOOL WORKS

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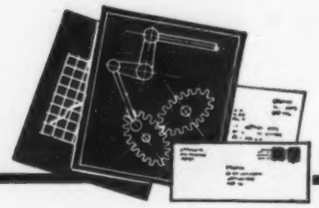
IDEA MART

DESIGN NEWS

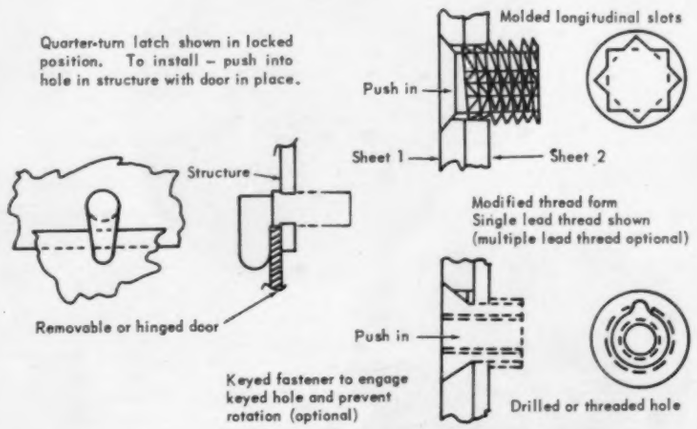


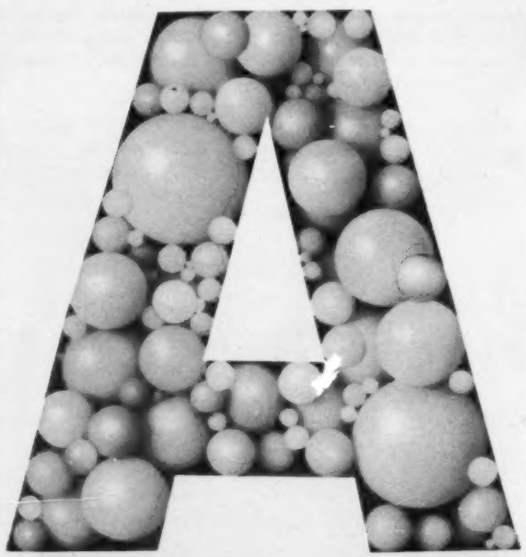
AVAILABLE

Self-Locking Blind Fastener

This molded nylon fastener pushes into a drilled hole and is retained by the resilient barbs on the periphery of the shank. The fastener can be rotated after installation unless it is a keyed-type fastener. A keyed hole into which a keyed fastener is inserted will prevent rotation so that attachments may be screw-fastened by self-locking internal threads in the fastener. The fastener has many applications for blind and non-blind attachments and may be used in such applications as plug, grommet, shelf bracket, drawer slide, knob and upholstery or trim attachment. Grip is limited only by length of barb area and no tools are required for insertion. Wish to sell or license. Write IM 524, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".


Quarter-turn latch shown in locked position. To install – push into hole in structure with door in place.
Structure
Removable or hinged door
Keyed fastener to engage keyed hole and prevent rotation (optional)
Molded longitudinal slots
Push in
Sheet 1
Sheet 2
Modified thread form
Single lead thread shown
(multiple lead thread optional)
Push in
Drilled or threaded hole



PRECISION PLASTIC BALLS

ACE is one of America's leading mass producers of seamless plastic balls for almost every commercial and industrial use. Most plastics including **nylon** and **teflon**. Complete range of sizes, colors and tolerances. Small runs or large runs. Huge stocks for immediate delivery. Quick, low-cost service on specials. Write, wire or call for samples, price lists and handy new selection chart.

SINCE 1931 A EXTRUDERS FABRICATORS

ACE PLASTIC COMPANY 91-26 VAN WYCK EXPWY · JAMAICA 35, N. Y.

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New! BEAD CHAIN® DRIVES

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NOW—BEAD CHAIN—QUALIFIED FOR DRIVES

Swivel-like Bead Chain and special non-slip sprockets make any drive possible . . . at low cost . . . eliminates expensive gears, universal joints, etc. Perfect for inaccessible locations!

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Chain of a thousand uses! Low cost, attractive, easy to use! 5 Sizes: 3/32" to 3/16". Strengths 20 to 200 lbs.
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TAG CHAINS

THE BEAD CHAIN MFG. CO.

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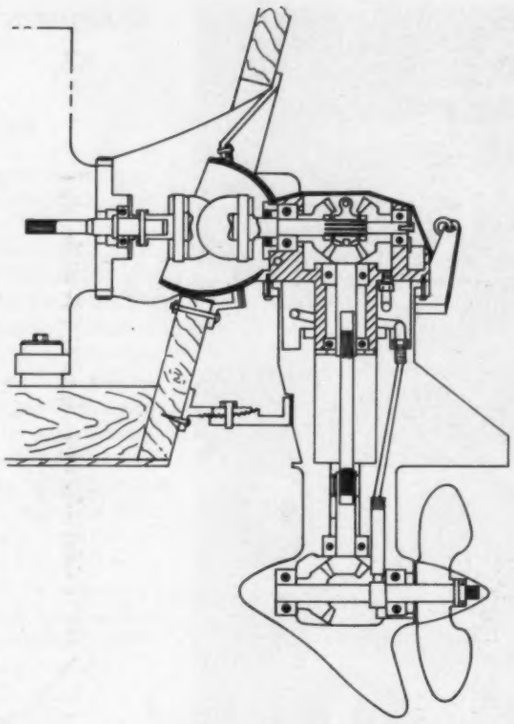
AVAILABLE

Transom Drive For Boats



Full tilting action with continuous power transmission is possible with this relatively simple, inexpensive transom-type drive. The unit uses a simple tongue and slotted-plate universal joint capable of up to 120-deg deflection of the driven shaft. In normal operation, the universal joint operates in a straight line with no sliding action, but freedom for 60-deg deflection is available for short intervals. Two designs have been developed around the universal joint. The first design utilizes the reverse gear in the upper gear box. The second design contains the reverse gear in the lower gear box. Experimental factors have been resolved, and the unit should present only routine production problems. Would like to contact interested firm for commercial development. Write IM 523, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

LOWELL
REVERSIBLE RATCHET WRENCHES
designed to solve your problems

Speed of operation, simplicity of ratchet control, great strength . . . these are three big reasons why machinery designers write Lowell Reversible Ratchet Wrenches into their specifications.

- Remote or conventional reversing control.
- Handles any length up to 6 ft.
- Socket openings any size or shape.
- Engineered for quality performance.

This Niagara double crank gap frame press for long die area work uses a special built-in Lowell Series 20 Wrench for quick adjustment of the slide.

WRITE TODAY FOR TECHNICAL DATA

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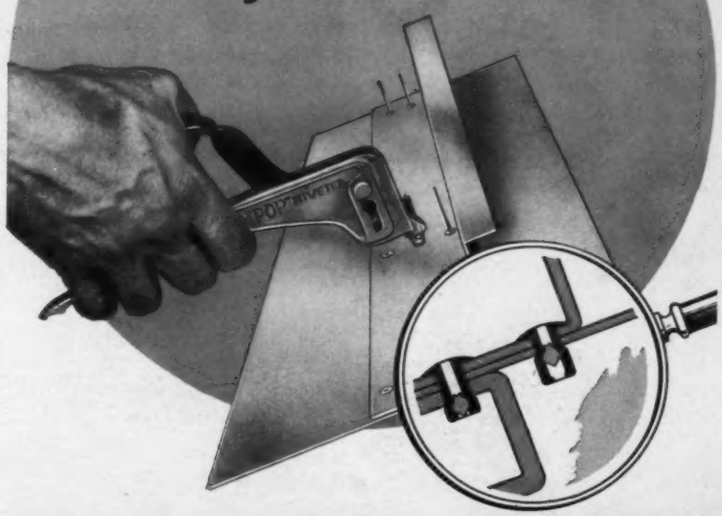
ONE OF THE
ONE DOZEN REASONS WHY
UNITED "POP"® RIVETS
run rings around the rest



WIDE GRIP RANGE

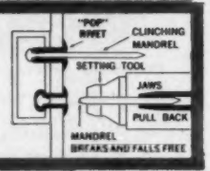
Wide grip range lets you use just one rivet length for thick or thin work sections. For example, a No. 610 "POP" Rivet has a grip range of nearly 5/8" and can be used for work from .020" to .065" in thickness! This simplifies your fastener specification problems . . . and greatly reduces your inventories. Ordering greater volume per size, you'll secure the lowest possible rivet price. You'll eliminate a source of operator error, because "POP" Rivets don't depend on close matching of rivet length to work thickness for high fastening quality. And this same non-critical length factor also makes "POP" the ideal fastening for thin materials; even .020" soft aluminum can be fastened securely without stripping!

If you want to improve the quality, appearance and sales appeal of your products . . . and cut fastening costs at the same time . . . be sure to investigate all of the reasons why "POP" Rivets run rings around the rest! Write today for complete information . . . and for the name of your local "POP" Rivet Distributor.

Genuine "POP" Rivets Are Available Through a Large Network of Distributors Throughout The Country.

UNITED "POP" RIVETS

HERE'S HOW THEY WORK
"POP" Rivets are inserted and set from the same side: (1) Rivet is inserted in the work. (2) Jaws of the easy-to-use setting tool grasp the mandrel. (3) Tool is operated. Jaws pull back. Rivet is set. Mandrel breaks and falls free.



FASTENER DIVISION • UNITED SHOE MACHINERY CORPORATION
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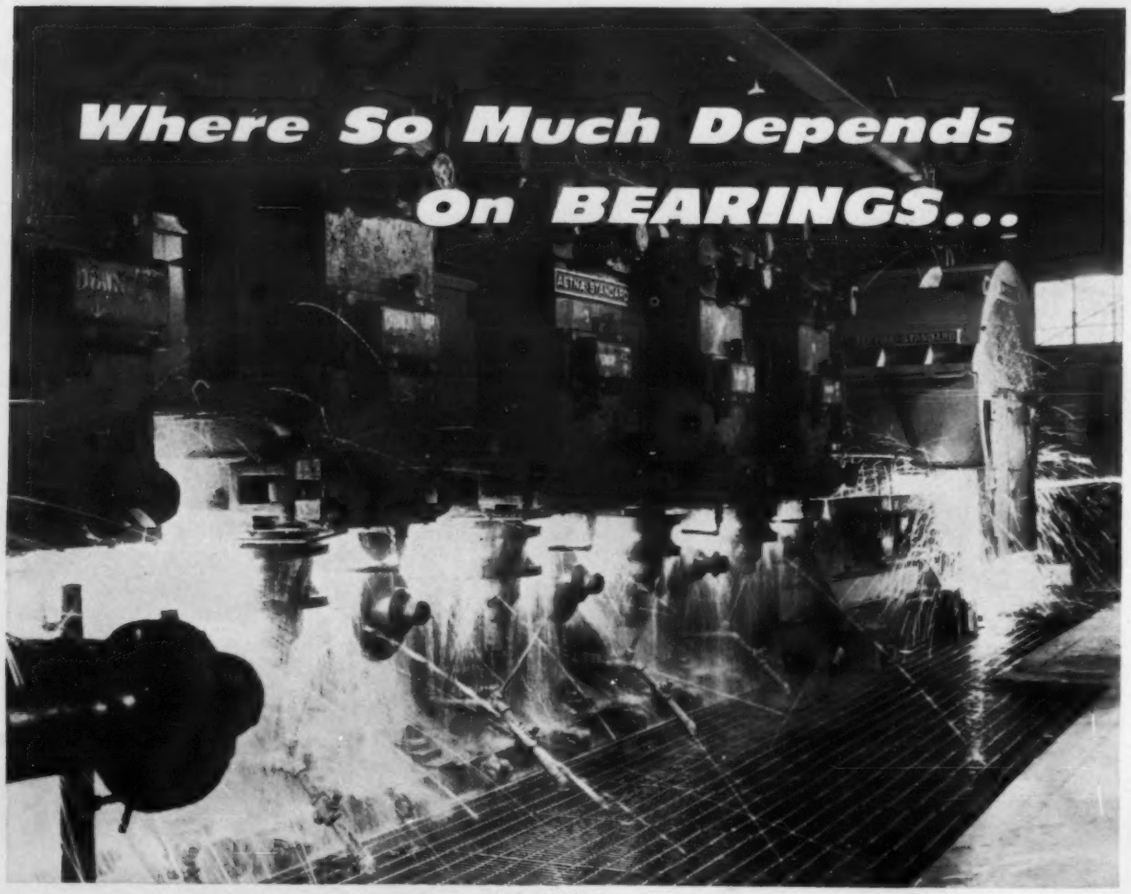

Rollway Bearing - equipped pipe - forming and welding stands at J & L Aliquippa Works. Rollways are also used in other equipment at Aliquippa, including cranes, crane hooks and mill motors.

It Pays to Depend On ROLLWAY

The addition of two Continuous Weld Pipe Mills has greatly increased Jones and Laughlin's monthly production of welded pipe. The mills have operated since 1957.

Both mills are Rollway Bearing-equipped, as are J & L's Stretch Reducing Mill and Electric Weld Tube Mill, installed at the same time.

Operations like these demand component reliability. Dependable Rollway Bearings regularly provide it. You can choose from a complete selection of sizes and types with maximum capacities. Consult Rollway's nearest Engineering Office to select the bearing just right for your job. Or start by writing for Product Line Catalog PL-559. Rollway Bearing Co., Inc., Syracuse, N.Y.

You can depend on

ROLLWAY BEARINGS

Radial and Thrust Cylindrical Roller Bearings

ENGINEERING OFFICES: Syracuse • Boston • Chicago • Detroit • Toronto • Pittsburgh • Cleveland • Seattle • Houston • Philadelphia • LosAngeles • SanFrancisco

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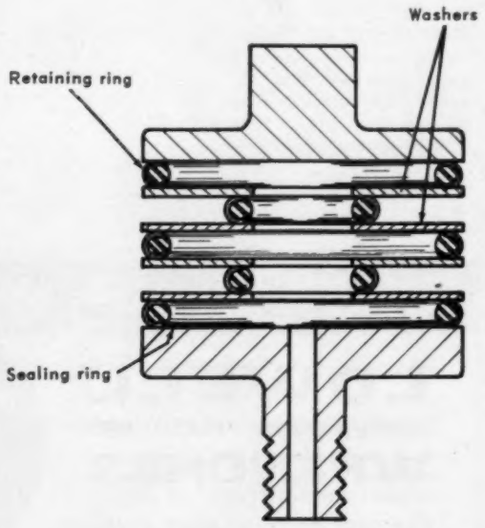
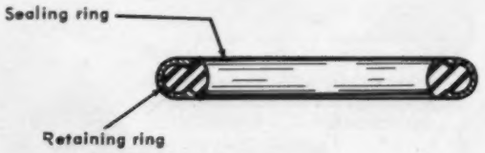
PATENTS

Bellows Structure

U. S. Patent 2,973,015; Tom H. Thompson, Sabre Research Corp., Daytona Beach, Fla.

The body portion of this bellows structure consists of several washer members, one above the other, sealed at inner and outer peripheries, alternately, by supporting rings. The load-supporting ring is substantially incompressible, with a cross-section which presents upper and lower surfaces abutting the washers. A sealing ring of resilient material is adjacent and concentric with the load-supporting ring. In a relaxed state, the sealing ring protrudes above and below the upper and lower surfaces of the supporting ring. When the washers are deflected, the sealing rings are compressed.





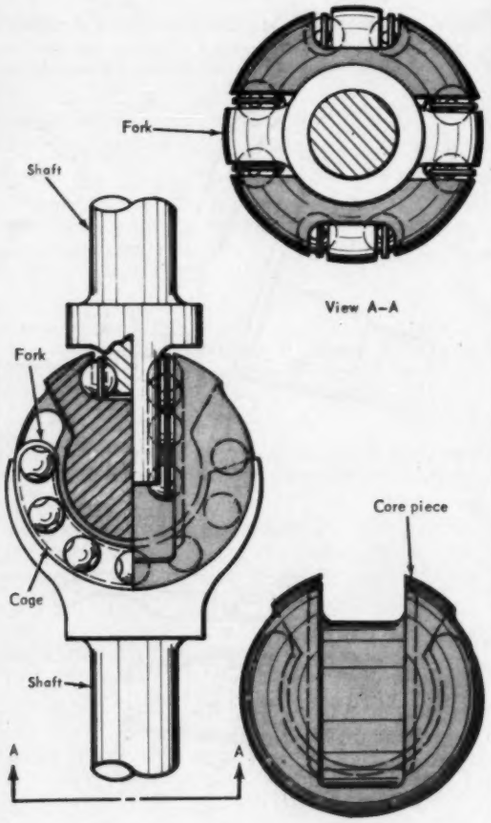
The load-carrying ring is of hollow section with an open side, forming a C-shape. The sealing ring is assembled with the load-carrying member by inserting the outer edge of the sealing member into the groove formed in the load carrying member. Several modifications of the device are possible.

Universal Joint

British Patent 856,063; Gelenkwellenbau GmbH, Westendhof 7, Essen, Germany.

The universal joint covered by this patent provides full torque transmission at shaft deflections up to 40 deg in both planes. Each shaft has fork ends located in grooves set at right angles in a central cylindrical core piece. When the shafts are aligned coaxially, the fork arms do not extend beyond the maximum core rotational axis.

The side walls of the grooves in the core and the adjacent flanks of the fork arms function as high-shouldered bearing surfaces for the balls. To permit transmission of full torque at wide angles, one ball in each race is not engaged until angular deflection exceeds 15 deg. Because the bearing grooves are loaded in a manner similar to that of a thrust bearing, wear is minimized, giving the joint long service life. The balls are retained by thin strip-type cages.

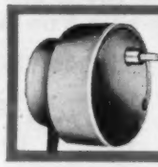


7 TYPES OF LOAD CIRCUIT OPERATION
ALL IN A SINGLE UNIT

Bristol's new Series 6100 gives you easy application with exclusive flexibility. No more complex wiring changes! Make circuit changes in a jiffy, too. You can reach the motor, and other parts—in seconds. The new "Bristol-Vision" dial is mounted in a square die-cast frame—provides better contrast for better viewing plus functional beauty too. Non-scratch bevelled *glass* dial cover won't buckle, deform—seals against dust. Powered by famous duty-matched standard Bristol motor. Write for brochure.

Contact the Bristol Distributor or Representative in your area.

SEND FOR HANDY TIMING CONTROL PRODUCT DIGEST —complete range of Bristol Motors, Timers and Timing Devices for all your timing and control applications.



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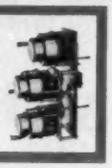

BRISTOL MOTORS *Division of Vocaline Company of America, Inc. / Old Saybrook, Conn.*

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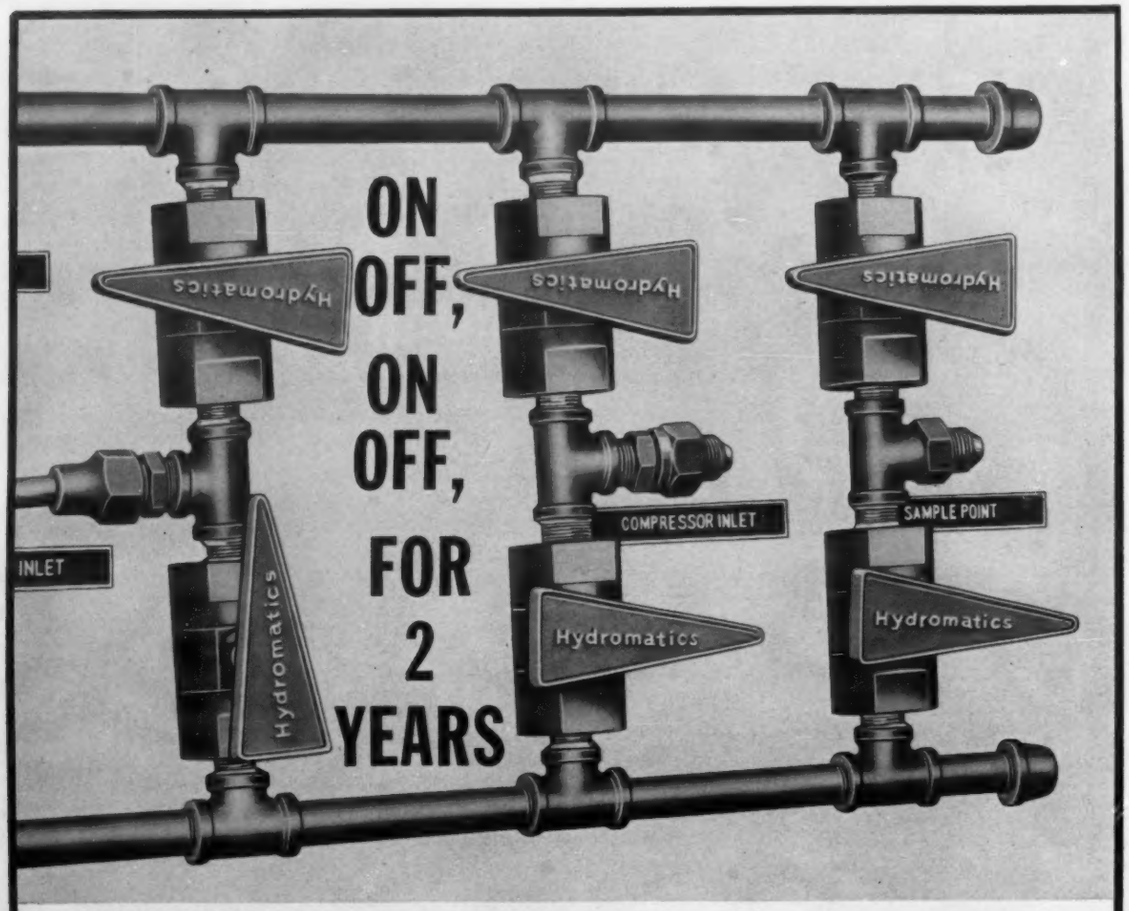

—AND STILL WORKING PERFECTLY!

Two years ago a leading processing plant installed FLO•BALL valves in lines controlling media at 3,000 psi. Previous longevity record was 3 months. Yet today, after 24 months of constant operation, the original FLO•BALL valves are still going strong — without a single breakdown!

Here are the facts on the Series 715 FLO•BALL Valves. It opens and closes with a fast **quarter** turn and its arrow shaped handle provides positive on-off indication at a glance. The FLO•BALL acts instantly at flow pressures from vacuum to 3,000 with low, low torque. And its exclusive design offers 100% flow efficiency — plus: zero leakage, universal mounting, removable flanges, all stainless steel construction. The non-metallic handle cannot conduct heat or cold to operator's hand. Short turning radius makes it ideal for panel mounting in close quarters. **Yet the FLO•BALL costs no more!**

Write today for complete information on Series 715 FLO•BALL in sizes from ⅛" to ½".

FLO-BALL

Hydromatics, Inc.

BLOOMFIELD, N. J. • PILGRIM 8-7000 • TWX = BLOOMFIELD, N. J. 120

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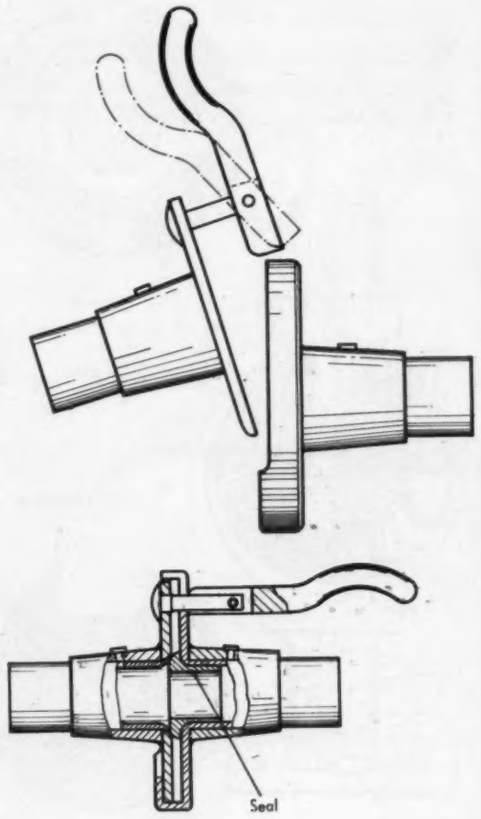
PATENTS

Pipe Coupling

British Patent 861,531; John A. Huggan, John Huggan & Co., Ltd., Evesham, Worchestershire, England.

This very simple, quickly operated, light-alloy coupling is operated by a cam-ended toggle lever. The lever is pivoted to a stud carried by an oblong male plate. The female plate constitutes a shallow flanged box-like receptacle with turned-up lip in which the male plate fits snugly as a cover. Side or endwise displacement between the plates is prevented by a peripheral flange. Short tubes with flared inner ends are secured tightly in both plate center bosses.

Watertightness is provided by a resilient material sleeve carried in the female plate and tube. When the plates are clamped together, the enlarged sleeve head is compressed between the short tube flared ends, which are aligned by the toggle lever action. The cam surface on the toggle lever end provides progressively increasing pressure when operated.



The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

HYDRAULIC COUPLING WITH FLUID CONTENT CONTROL
U S Patent 2,987,887; F. Robert J. Fowler, Flint, Mich., assignor to General Motors Corp., Detroit, Mich.

HYDRAULIC MASTER DRIVE UNIT
U S Patent 2,987,888; Gordon W. Crowell, West Point Pleasant, N. J., assignor to Crowell Designs, Inc.

HYDRAULIC STEPPING MOTOR
U S Patent 2,987,889; Daniel P. Darwin, Endicott, N.Y., assignor to International Business Machines Corp., New York, N.Y.

SPEED-CONTROL UNIT
U S Patent 2,987,925; Roy H. Randall, R.R. 2, Manchester, Mich.

PULLEY
U S Patent 2,987,933; Henry L. Barnes, 1406 W. Lake St., Minneapolis, Minn.

VISCOUS FLUID TORSIONAL VIBRATION DAMPER
U S Patent 2,987,938; Lewis D. Burch, Algonac, Mich., assignor to General Motors Corp., Detroit, Mich.

PUMP
U S Patent 2,988,010; James P. Fay, 18 France St., Norwalk, Conn.

ROTATABLE SPOOL DISTRIBUTOR VALVE
U S Patent 2,988,107; John Rudelick, Milwaukee, Wis., assignor to Bruner Corp., Milwaukee, Wis.

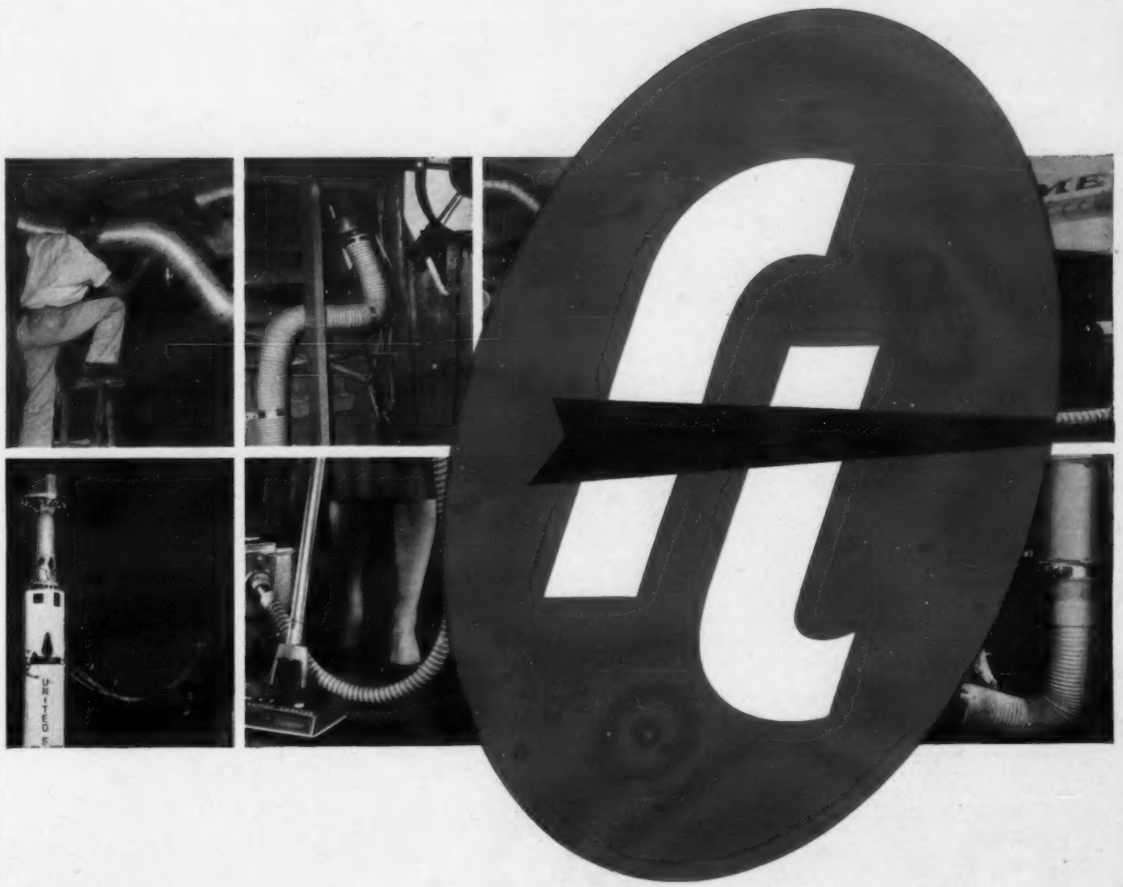
VEHICLE BRAKE
U S Patent 2,988,176; William H. DuBois, South Bend, Ind., assignor to The Bendix Corp.

CLUTCH
U S Patent 2,988,187; Warren Doble, North Hollywood, Calif., assignor to Jabsco Pump Co., Costa Mesa, Calif.

TEMPERATURE-SENSITIVE DRIVE
U S Patent 2,988,188; Max J. Tauschek, Lyndhurst, Ohio, assignor to Thompson Ramo Wooldridge, Inc., Cleveland, Ohio.

FLUID SEPARATING VALVE
U S Patent 2,988,282; Frederick W. Hottenroth, 2107 Chatfield Drive, Cleveland Heights, Ohio.

FLUID FLOW-CONTROL DEVICES
U S Patent 2,988,321; Roger Gilmont, Douglaston, N.Y., assignor to Manostat Corp., New York, N.Y.



"This is you,"
the people say...

When we designed this unique trade-mark for our line of nonmetallic tubes and ducts, we wanted to find out what sort of image it projects. So we showed it to people all over the country — people who know Flexible Tubing.

"It says Flexible Tubing is fast-growing, dynamic," was the way someone put it. "It says you're a research-oriented company," another commented.

Still others said: "your new trade-mark gives you a years-ahead look" . . . "tells me that Flexible Tubing is a company that's really going places" . . . "says you're keeping pace with age of Space."

"This is you," the people say about our new trade-mark. You'll find it now — big and bold! — on Flexible Tubing products made for original equipment, plant maintenance, air conditioning distribution systems, swimming pool vacuum cleaners, home laundry venting, aircraft and missiles.

Write today for Catalog 10-19. It describes the wide range of Flexible Tubing products available for your use.

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208 New Whitfield St., Guilford, Conn.
Anaheim (Los Angeles) • Hillside (Chicago)
Atlanta • Cleveland • Dallas • Denver • San Francisco • St. Louis • Wichita

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What IS a GOOD DRY FILM LUBRICANT APPLICATION

CASE HISTORY 768

Large, automatic water valves for city water mains. EverLube eliminates sticking and other malfunctions. The plug, seat, screw, operating lever and bearing were EverLubed.

FACTS . . . not fantastic claims to assist you in design lubrication

EverLube Design Handbook

This design handbook is yours free . . . written to provide valuable assistance to the design engineer . . . explains the good and the poor applications for dry lubricants.

When specifying dry film lubricants, call for a qualified product under USAF MIL-L-25504 or NAM, MIL-L-22273 (WEP).

Custom shops in principal cities

EverLube Corp. 6940 Farmdale Ave. No. Hollywood, Calif.

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OUT OF THIS WORLD *Heating Elements*

LOW WEIGHT

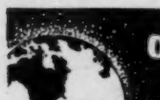
STABLE AT −400° F

IDEAL FOR IRREGULAR SHAPES

WILL NOT GLOW OR SUPPORT COMBUSTION

NO OUT-GAS IN VACUUM

OPERATIONAL TEMP. TO +500° F



Thermolab element on bearing retainer of lox turbine.

Wave guide heated evenly with the Therm-O-Lab element.

Container used to hold electrolyte solution for missile battery.

THERM-O-LAB Sprayed-on Film Type Heating Elements Are SPACE ACCLIMATED!

Completely Inorganic

Applied to: ✓ Stainless ✓ Copper ✓ Glass ✓ Aluminum ✓ Brass ✓ Steel

Specialists in

SPACE HEATING REQUIREMENTS

Since Therm-O-Lab sprayed-on elements are only .015" thick and weigh less than one gram/in², the designer can put heat exactly where needed . . . space acclimated to withstand acceleration, vibration, radiation and cryogenic temperatures. Its total contact to the surface provides maximum heat transfer. Therm-O-Lab offers complete heat system capabilities.

Write or wire

THERM-O-LAB CORP.

6940 Farmdale Ave., North Hollywood, Calif.

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DESIGN IDEAS NEWS

ELECTRICAL

Momentary-Contact Switch Provides Uniform Pulses

Lars G. Soderholm, Midwest Editor

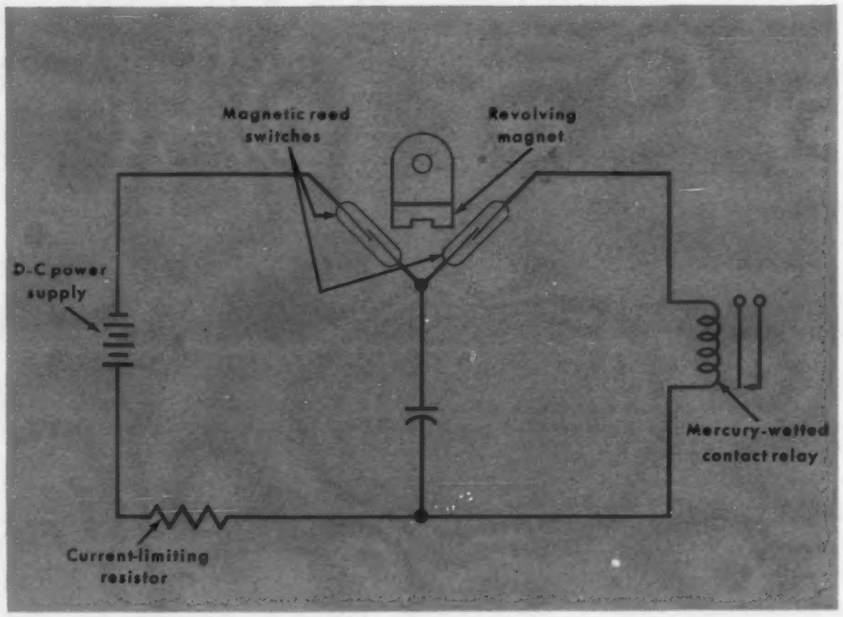
A momentary-pulsing switch uses a four-pole ceramic magnet to alternately actuate two magnetic reed switches. The first switch charges a condenser while the second switch dumps the charge through the coil of a mercury-wetted relay. The capacitance and the resistive inductance of the relay are designed to provide a relatively constant 30-ms pulse at all switch input speeds.

Previous units of this type usually have operated through a series of miniature switches actuated by a cam. They presented specific problems in not being moisture-resistant and in having high torque load and high-speed limitations. Variable duration of contact while the switch was closed allowed current drain and caused limited life.

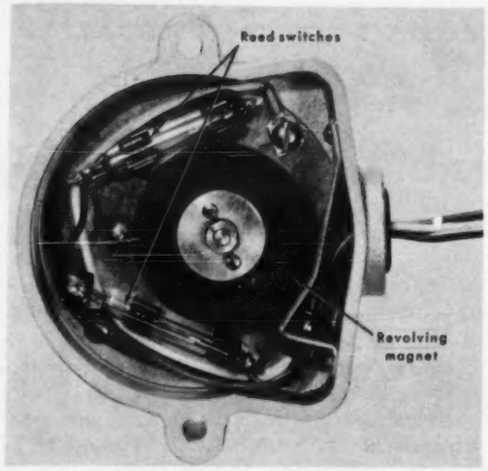
To overcome some of these shortcomings, an electrical circuit was developed that would send relatively uniform pulses at up to 1200 pulses per minute. To extend operating life of the unit and eliminate electrical hazard, only low voltages were used. In the 115v a-c model, the alternating-current is transformed and rectified to a 6v level. A 6 or 12v model is also available.

The momentary-pulsing switch is mounted in place of a register and is driven by a liquid-metering device. The ceramic magnet can be geared to provide up to 1000 pulses per minute. Electrical pulses from the mercury-wetted relay can be used to operate a totalizing counter, a repeat cycle counter for batching or to pace a chemical feeder pump.

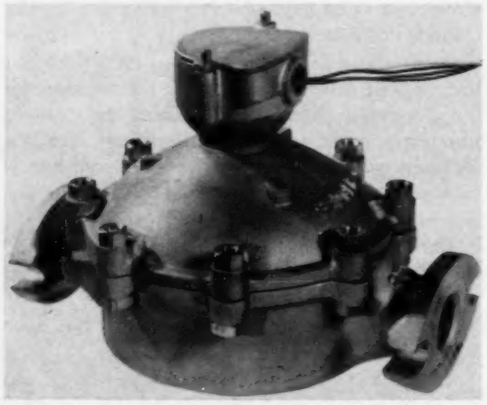
The momentary pulsing switch was designed for use with Model RBC Remote Repeat Batch Controller and Model RR Remote Read-Out by the Badger Meter Mfg. Co., Milwaukee, Wis.



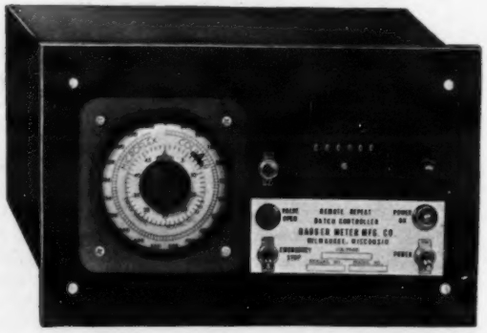
MOMENTARY-CONTACT SWITCH WIRING DIAGRAM



MOMENTARY-CONTACT SWITCH has two magnetic reed switches and revolving magnet. Only one switch is closed at any one time.



PULSING SWITCH PACKAGE is attached to meter measuring fluid flow. Gearing permits adjustment of pulse to volume-of-flow ratio to suit user's requirements.



REMOTE REPEAT BATCH CONTROLLER uses pulses from momentary-contact switch to repeat batch settings up to 1000 gal. It has reset totalizer, counter for batch quantity, start switch and stop button for interrupting operation.

NEW 20-AMP Variable Transformer

VT20B—
IN BASIC ENCLOSURE

OHMITE SERIES VT20

SHOWN ⅔ ACTUAL SIZE

FEATURES

A Base has elongated mounting holes and other features which give the VT20 universal mounting capabilities. Can be used as a *direct replacement for other popular transformers* of comparable size.

B Radiator plate is counterbalanced in conjunction with the brush assembly for smooth operation and stability under vibration.

A & B Unusually fast heat dissipation results from carefully designed base and radiator plates.

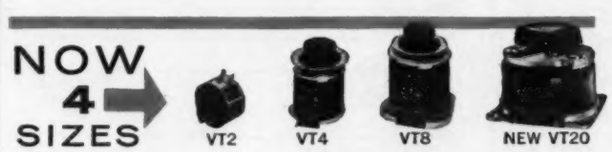
C Adjustable shaft extends from either end of the transformer as required for panel or horizontal surface mounting. *Unique, collet-type lock permits repositioning without scoring or defacing the shaft.*

D Extra large brush assembly gives a big margin of heat dissipation . . . is accurately counterbalanced by radiator plate design.

E Terminal panel allows quick arrangement of *clockwise or counterclockwise* increase of voltage for "line" (120 V) or "overvoltage" (140 V) maximum output.

VT20 VARIABLE TRANSFORMERS CURRENTLY STOCKED

Cat. No.	Input (Sing. Ph.)		Output		Rot. Ang.
	Volts	cps	Volts	Amps	
VT20 VT20B	120	50-400	0-120/140	20	317°



WRITE FOR BULLETIN 165

OHMITE MANUFACTURING COMPANY
3616 Howard Street, Skokie, Illinois

Rheostats Power Resistors
Precision Resistors Variable
Transformers Tantalum Capacitors
Tap Switches Relays R.F. Chokes
Germanium Diodes Micromodules

OHMITE

Circle 37 on Reader-Service Card for more information

Time Indicator Uses Mercury

Victor W. Wigotsky, Eastern Editor

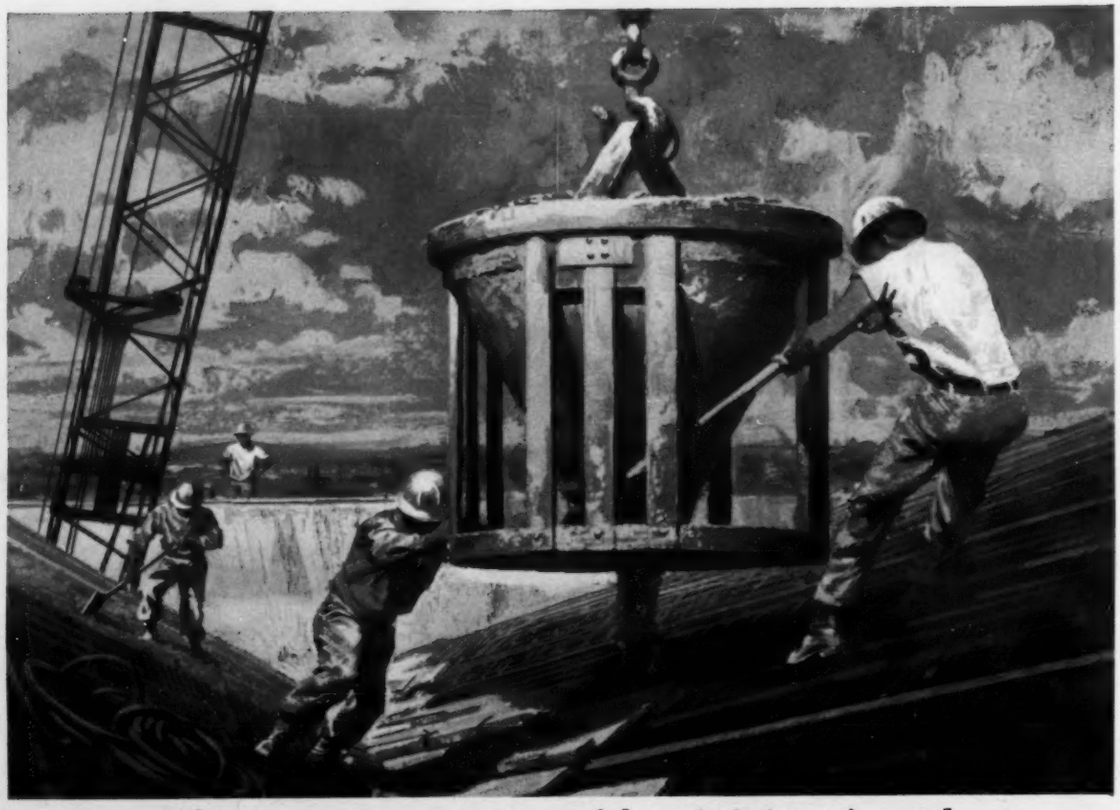
An elapsed-time indicator is based on the principle of the mercury coulometer. Design takes advantage of the coalescence characteristics of a liquid, as opposed to a solid, during the process of electrolytic deposition. Unit is inexpensive, small and lightweight and can operate under environmental conditions generally encountered in military applications.

The time indicator consists of anode and cathode chambers, separated by a microporous filter element. Initially, the anode chamber contains a quantity of mercury and a small amount of electrolyte. The reverse condition exists in the cathode compartment. Mercury ions migrate through the separator and mercury collects on the cathode when a current is passed through the electrolyte. Mercury falls from the cathode into a graduated tube at a rate of 0.04 inch per 50 hours when the current in the electrolyte is 0.51 milliamp. Platinum wire, 0.010 inch in dia, was chosen for the electrodes.

The housing is molded of "Lucite" (0.53 inch thick, 1.06 inches wide and 2.18 inches long) resulting in a total assembly weight of 1.2 oz. The unit will operate in any position, but must be vertical to be read.

The Time Totalizer (patent pending) was designed by S. Godel and T. Descovich, Research and Development Div., American Machine & Foundry Co., New York, N. Y., for AMF's Leland Airborne Products Div. Leland will manufacture the device.

ACCURATELY CONTROLLABLE MERCURY DEPOSITION in reading tube is assured by low-cost electronics which regulate cell current to 0.51 milliamp, plus or minus 1-1/2 percent, for both 115v a-c and 28v d-c operation. Electrical connections are made by means of two screws for terminals. Especially treated mercury is used to provide proper coalescence in reading tube. Plastic microporous separator material passes electrolyte while remaining impermeable to mercury, except electrolytically. Electrolyte contains mercury iodide and can withstand temperature extremes in excess of minus 35C to plus 71C. Double-anode Zener diode is used as voltage regulator in d-c unit and neon lamp for a-c. Unit can be used to determine component replacement equipment operating time and as battery life indicator. Total accuracy is plus or minus 6 percent.



Now a new converter with a 3.6:1 ratio and

POWER-LOAD-LOWERING SAFETY, TOO

Now, from Allison, comes a converter with new efficiency, new design elements, new low prices that gives you the safety of power-load-lowering and 3.6 to 1 stall-torque ratio too.

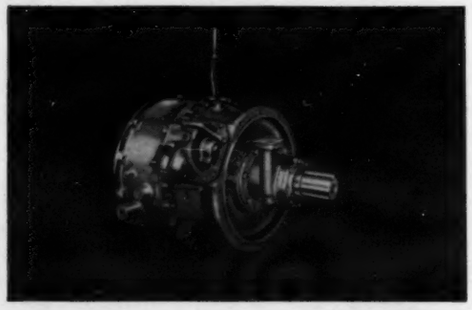
It's the new Allison TC-400 TORQMATIC Converter, a breakthrough in converter design from the people who make the world's most complete line of hydraulic drives.

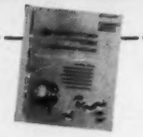
The TC-400 is as new as tomorrow – but incorporates the time-proved TORQMATIC design features which for years have demonstrated their merit on tough job after tough job.

It can handle from 150 to 250 horsepower, is far more efficient than other converters in its range. It's available with a front disconnect clutch, industrial or automotive flange, tailshaft governor and integral charging pump for operating customer transmissions.

And this 3-element converter offers you a choice of 3 different stall-torque multiplication ratios—from 2.9 to 3.6 to 1—at no extra cost.

Want the full story? Mail the coupon—today.





Allison TORQMATIC® DRIVES

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Over 980 Models used by 108 Manufacturers in 100 to 525 H.P. Equipment

ALLISON DIVISION OF GENERAL MOTORS
DEPT. DN-6 INDIANAPOLIS 6, INDIANA

Please send me application data on your TC-400 TORQMATIC Converter.

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

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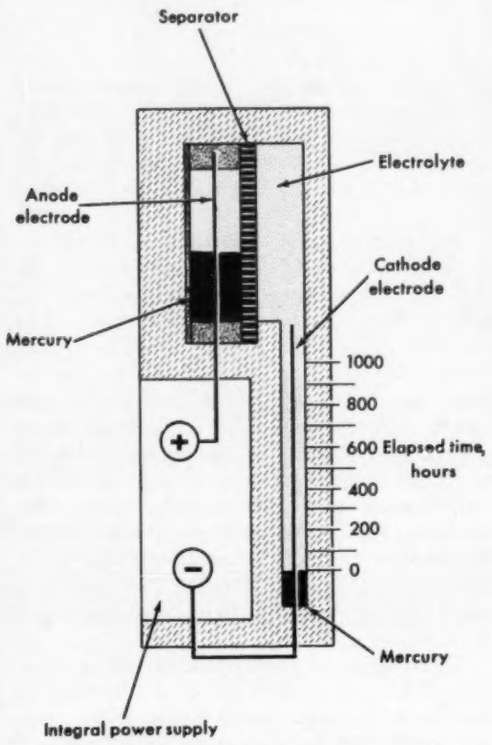
Coulometer Principle



Subjected to 15 PPM ozone for more than 5 hours, rubber drain hose cracked severely, broke when bent. Under same conditions, colored HYPALON-veneered hose remained tough, lively, crack-free!

OZONE IMMUNITY

One more way HYPALON® helps assure maximum appliance reliability

Ozone is death to natural rubber. Ordinary synthetics, too. Causes them to completely lose their resilient, rubber-like properties. Ozone-cracked appliance hoses, gaskets and molded rubber parts create customer complaints, boost servicing costs.

Du Pont HYPALON, however, solves this problem once and for all. HYPALON is *ozone-proof*. No other rubber can match its immunity from attack by any concentration of ozone.

HYPALON synthetic rubber also has excellent resistance to oxidizing acids and chemicals, oil and grease, abrasion and natural aging. Retains its resilience at high and low temperatures. Won't propagate flame. And it's color stable. All this makes HYPALON your best choice among elastomers for "service free" appliance design. Write today for more information. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department DN-8, Wilmington 98, Del.

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HYPALON®
SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*

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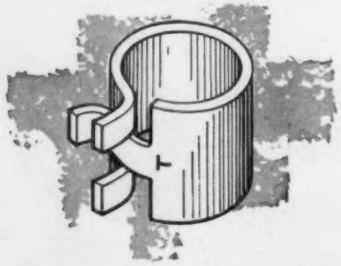
INFORMATIVE NOTES TO IMPROVE YOUR PRODUCT ...SAVE YOU MONEY

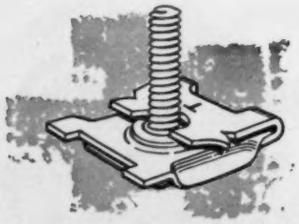
Published as a service to Designers and Engineers

Ideas from Tinnerman have cut costs, improved products. Here are examples from Tinnerman's 10,000 variations of SPEED NUT brand fasteners —all stamped with the T-mark of *total* reliability.

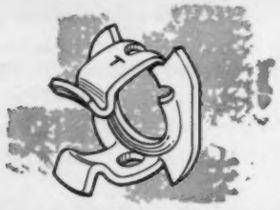
Tinnerman can help *you* cut costs with a free Fastening Analysis of your product. Call your Tinnerman representative, or write: *Tinnerman Products, Inc., Department 12, P. O. Box 6688, Cleveland 1, Ohio.*



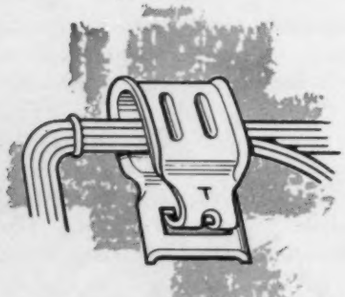
VERSATILE COMPRESSION RING has solved fastening problems in car radios, pressure gages, washers, and speaker cabinets. Simply squeeze compression fingers with pliers to expand . . . release, and spring tension maintains firm connection. Heat-treated spring steel of this SPEED CLIP® fastener won't lose tension, won't loosen under vibration. Possible applications are practically unlimited.



BOLT RETAINER used to fasten grille extensions to car fenders, has potential usage in any field where high-torque fastening is required on thin metal sections. This SPEED GRIP® fastener eliminates costly welding or staking, speeds assembly, allows savings in labor costs and parts handling. Barbs locate fasteners until nut is driven. One of Tinnerman's extensive line of SPEED GRIP nut and bolt retainers.



ELECTRONIC CONTROL CLIP retains tuning switch on chassis, gives constant spring tension for both push-pull and revolving controls . . . can be used wherever electronic controls are installed. This multipurpose SPEED CLIP fastener replaces threaded nuts, bushings, lockwashers. Cuts costs substantially. Live spring action lasts for the life of the equipment.



WIRE RETAINER is ideal for attaching single wire, light harness, cables or tubing. This SPEED CLIP fastener can be preassembled on the harness, allowing an entire wiring system to be snapped into place in seconds. Double embosses on upper clamping leg trap cold-flow tendencies of vinyl covered cord, assure 35 pound pull resistance. Clip will accept any wire or bundle up to .306" x .515".

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano Simmonds GMBH, Heidelberg.

TINNERMAN Speed Nuts®
Look for the Tinnerman "T"

Circle 40 on Reader-Service Card for more information

Tester Checks

Edward W. Schrader, Western Editor

A dynamic tester for encoders works on the principle of autocorrelation of successive, extremely short time duration samples at a 6.25-kc rate. The logic circuitry of the tester requires that successive output words have changing value with an absolute difference no greater than one binary digit.

The encoder brush outputs are scanned continuously by a serial V-scan brush selection matrix and periodically sampled during the gating time of the 120-nanosecond clock pulse. The sampled V-scan is fed into a 13-bit word shift register and serially compared bit by bit with the previous contents of the shift register. If the encoder is functioning properly, counting in sequence, the following possibilities exist when the two 13-bit words are compared: the encoder has not advanced to the next least significant digit; therefore, the comparison is zero, the encoder has advanced to the next least significant digit in one direction or the other; therefore, the comparison results in an absolute difference of one which is + or —1.

The comparison circuitry allows for a difference of 0, +1 or —1. If any other difference results from the comparison of the two 13-bit words, the comparison logic generates an error signal. This error signal inhibits the clock pulse which stops all functions of the tester, energizing the corresponding track light on the error display.

Following the comparison word time (80 μsec), the comparison circuitry and the shift register are static for one-word time during which the contents of the shift register are displayed on the 13 indicator lights of the encoder display.

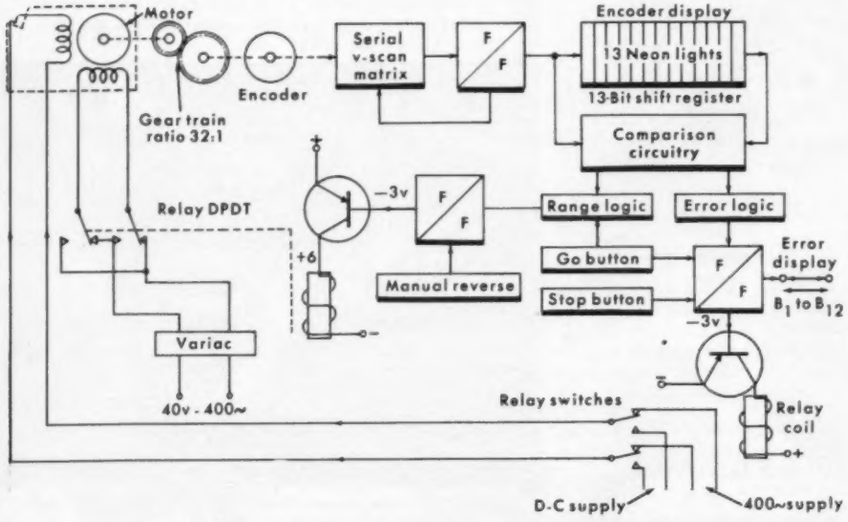
When the encoder is driven to its zero value output position, the range logic generates a reversing signal which causes the encoder shaft drive to reverse direction. Thus the encoder is driven through its entire output range of 2^{13} in one direction, then automatically reversed and driven through its full range in the other direction.

The tester self-checks its error circuitry. Momentary depression of the push-to-test button simulates an encoder miscount on the B_{12} track.

The dynamic encoder tester is a design development of the Computer Systems Laboratory, Litton Systems, Inc., Woodland Hills, Calif.

If Encoder Counts Correctly in Sequence

BRUSH-TYPE V-SCAN SHAFT ANGLE ENCODER is checked on dynamic tester. Tester performs high-frequency, short-time-duration sampling of V-scan output. Correct encoder output is determined by self-correlation with V-scan selection logic internally contained in tester. Tester is extremely sensitive to high-frequency sliding contact noise. This kind of noise is inherent design problem in all brush-type encoders.



BLOCK DIAGRAM of tester shows output flip-flops for driving two-phase servomotor. Minus 3v signal from one flip-flop drives transistor and coil for DPDT relay to energize control winding of motor. Second flip-flop output shows error display and drives transistor which in turn drives DPDT relay for plugging d-c voltage to reference winding of servomotor, thus stopping motor on error.

Diameters from 2″ to 32″. Capacities range from 1 quart to 100 gallons.

RELIABILITY is built right into Hackney-made components

Hackney forming methods produce strong, lightweight, seamless shells the cold drawn way. With smooth, clean surfaces, consistently uniform side walls and closely controlled tolerances, performance reliability becomes an integral part of every Hackney deep drawn shape or shell.

You will find plenty of design latitude in our methods because we make available to you a vast assortment of dies, mandrels and related tooling to match your ideas. Units can be made in sizes from 1 qt. to 100 gal. Diameters range from 2″ to 32″. Lengths may be from ½ to 5 times the diameter, or up to 110″... working pressures to 10,000 psi, depending on diameter.

Hackney experience and facilities can form your components in steel, magnesium, nickel, ultra-high-strength stainless steels, hot work tool steels, molybdenum or titanium. Let our engineers help you work out details and suggest ways to improve reliability... reduce cost. For complete information, write to the address below:

Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

1440 South 66th Street, Milwaukee 14, Wisconsin

Branch offices in principal cities

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

Circle 41 on Reader-Service Card for more information

Actuator's Linkage Multiplies Small Air Gap Movement

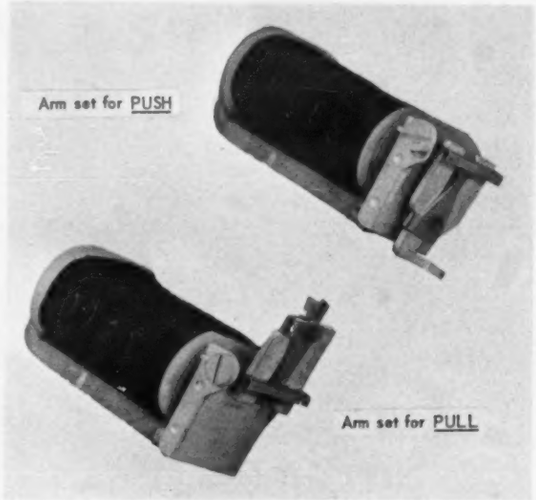
Victor W. Wigotsky, Eastern Editor

A linkage system multiplies the movement in the magnetic air gap of a solenoid actuator. Keeping the magnetic gap small assures high force and stroke efficiency.

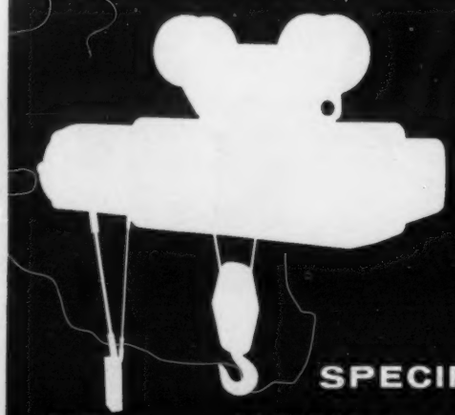
The actuator's short stroke is coupled to the load by a ten-to-one lever system. This provides 0.0620-inch motion at the load moving point.

Unit also features a low-cost bearing system which minimizes lost stroke, caused by bearing wear, over an estimated 20 million operations. Bearing blade-edges, held by a spring clip, rest against the linkage's movable arm and simulate a roller-bearing action. The parts roll on each other within the limited angular motion of 12 deg. This provides the effect of a conventional roller bearing at lower cost and with less space.

The Type L13 d-c solenoid actuator was designed by James Cunningham, Son and Co., Inc., Rochester, N. Y.



FOR CASTINGS THAT UNDERGO
HEAVY SHOCK AND HIGH STATIC LOADS



SPECIFY
PRECEDENT 71
ALUMINUM CASTING ALLOYS

HIGH YIELD STRENGTH • HIGH SHOCK RESISTANCE

Precedent 71 A and B are high strength, shock resistant aluminum sand casting alloys which in the condition as cast and aged at room temperature, develop the highest combination of physical and mechanical properties of any such alloy now available. Precedent 71A as cast and fully aged has a yield strength of 36,000 p.s.i. As solution heat treated and aged in the T6 condition, it has a yield strength of over 40,000 p.s.i. and still has over 5% elongation. Precedent 71B as cast and fully aged has a yield strength of 32,000 p.s.i. and at the same time has 7% elongation. Precedent 71 A and B offer a combination of high yield strength and high shock resistance not found in other aluminum casting alloys.

Write Today for Free Bulletin

WILLIAM F. JOBBINS INCORPORATED

P. O. BOX 230A
AURORA, ILLINOIS

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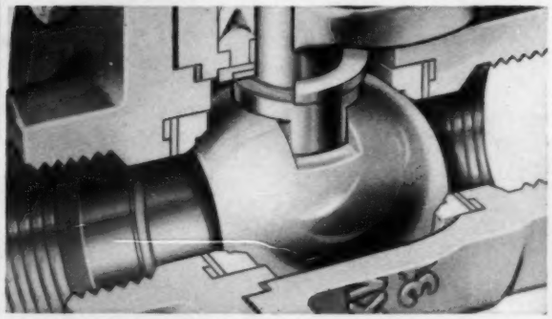
IN ROCKWOOD BALL VALVES



Rubber or Teflon Seats?

Rubber outperforms all other materials. It is tough, abrasion-resistant . . . seals tighter, longer. Teflon is used only for corrosion and high temperature resistance.

Whether Teflon or rubber is used, *Rockwood Ball Valves* are best for all applications. Rockwood Ball Valves have larger waterways per valve size, a wider choice of valve types and the most durable construction.

For details write Rockwood Sprinkler Company, Ball Valve Department, 854 Harlow Street, Worcester 5, Mass. Distributors in all principal industrial areas. Rockwood Sprinkler Company, A Division of The Gamewell Company, A Subsidiary of E.W. Bliss Company.

ROCKWOOD
BALL VALVES

Circle 43 on Reader-Service Card for more information

How to save money

Before manufacturing begins, J&H engineers screen cost out of your small precision stampings and deep-drawn parts. They do without special tools, if possible . . . simplify designs . . . reduce operations. Result: quality . . . low cost . . . quick delivery. Write for free estimate and Bulletin 81.

Choice of metals and finishes. Sizes to 2.75 in. OD and 3.75 in. deep.

An affiliate of Superior Tube Co.
J&H
JOHNSON & HOFFMAN
MANUFACTURING CORPORATION
31 East 2nd Street • Mineola, New York • Pioneer 2-3333

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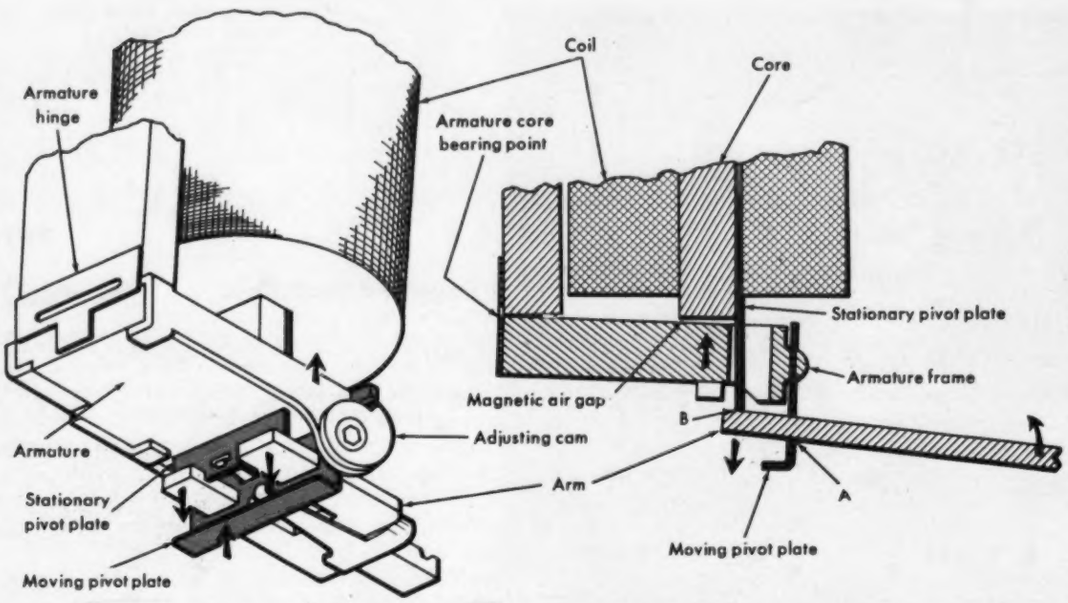


LINKAGE can be assembled for either push or pull action. Moving pivot plate, fastened to armature by frame, is moved against arm at bearing point (A). Arm rotates about bearing point (B). Free end of arm is coupled to switch contact or other device. Closing force of 1 lb is provided in approximately 15 millisec at normal 1.5w. Operating time is reduced to 4 millisec when overdrive power is used for short periods. Moving blade rotates on its mounting button during cam adjustment for bearing alignment. Armature also rotates against core in line contact bearing. Armature hinge is thin stainless-steel part welded in place, provides alignment and rolling action. Uniform rise cam, adjusted with 1/6-inch hex wrench, permits stroke setting with infinite resolution over approximately 1/6 inch at load point.

THE AMPLEXOLOGIST

dreams up a gear train

The Amplexologist designed this gear train (plus ten other parts) especially for powder metal production—at the request of a manufacturer who called him in at the design stage. All (except the helical gear) are finished precision parts which require only shaving. Estimated savings; 86%. Sound interesting? Call the Amplexologist.

AMPLEX
DIVISION CHRYSLER CORPORATION DETROIT 31, MICHIGAN
OILITE

SEND FOR THE SECRET OF THE AMPLEXOLOGIST'S SUCCESS

1 ENGINEERING MANUAL
45 pages of technical information: How to determine correct applications for powder metal parts, bearings, filters.

2 NEW BEARING STOCK LIST
20 pages. 1066 standard sizes of Oilite self-lubricating bearings—bearing material. Selection guide, engineering data.

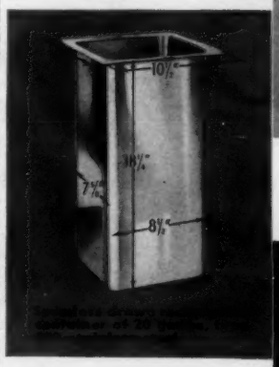
Circle 45 on Reader-Service Card for more information

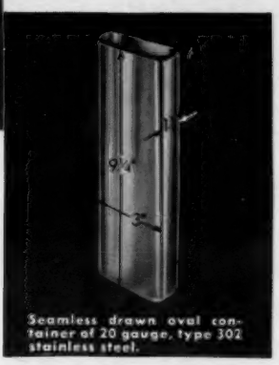
No Tooling Cost To Draw Shapes Like These

and dozens of others

with **POLAR WARE Facilities**

Seamless drawn cylindrical container of 22 gauge steel.





Seamless drawn oval container of 20 gauge, type 302 stainless steel.

■ It will pay you to check out your new design ideas with Polar Ware. The chances are good that our hundreds of existing dies, plus the facilities of our complete tool and die shop, can save you thousands of dollars in tool cost, plus weeks of waiting time. Difficult seamless deep drawing work in stainless steel is our specialty, in gauges from 3 to 30; also carbon steel and aluminum. Take advantage of our more than 50 years' experience in metalworking. Without obligation, send your inquiry to the Contract Department.

Polar Ware Co.
4200 Lake Shore Road—Sheboygan, Wisconsin

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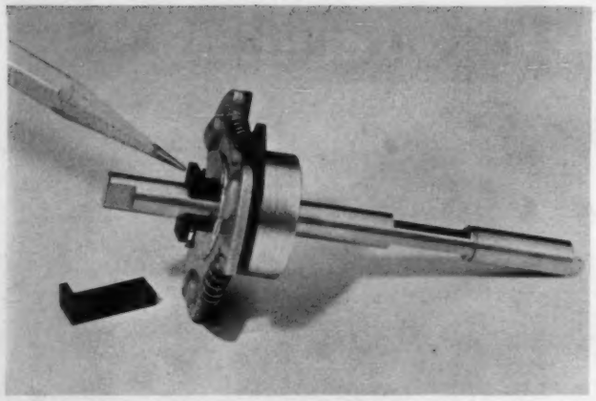
NEW PRODUCTS

Circle number on Reader Service card for more information

Stepping Motor 301

Utilizes Sintered Nylon Ball Cage and Shaft Keys



Rotary components, requiring a low coefficient of friction and permanent lubrication to minimize frictional load, utilize a sintered nylon ball cage and shaft keys. These critical components are design applications of an indexing device called a "Digimotor". Keys and cages were formed from finely divided nylon and molybdenum disulfide sintered in oil. In this application, the ball cage is alternately in sliding contact with the steel armature plate and with a fixed member of the steel housing during indexing or stepping. Three compression springs bias the cage to hold three steel balls in the shallow ends of ball races in the armature plate. When the motor coil is energized, a strong electromagnetic pull closes an air gap, causing the three balls to roll to the deep end of the races, rotating the armature plate and hub. At the same time, cage is carried forward, compressing the three springs. When coil is de-energized, springs press cage against balls and force them to shallow ends of ball races. Because of incline of races, balls force armature plate and hub outward along shaft, completing cycle. Rapid cycling is impossible if there is too much frictional drag between ball cage and armature plate or housing member. Another problem—noise—is solved by the resilience of nylon. Sintered parts absorb minute vibrations and prevent chatter. The stepping motor of Ledex, Inc., has high torque-to-size ratio.

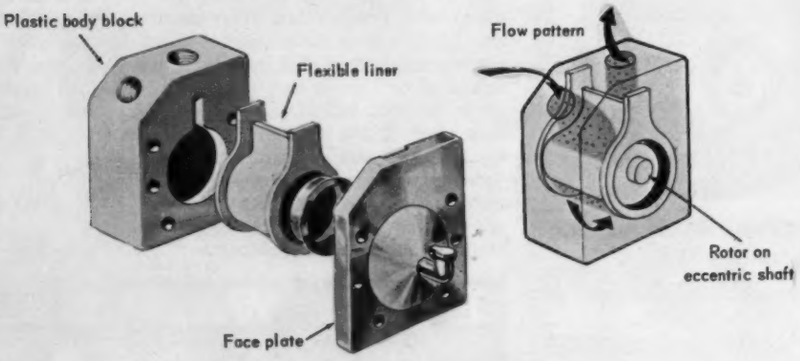
Polymer Corp., Halex Div., 2120 Fairmont Ave., Reading, Pa.

Low-Cost Plastic Pump 302

Has No Stuffing Boxes, Shaft Seals, Valves, Gaskets

Pumping in this compact rotary component is accomplished by a rotor on an eccentric shaft, which turns within a flexible liner. This design creates a progressive squeegee action on fluid trapped between the synthetic liner and the plastic body block. Stuffing boxes, shaft seals, valves and gaskets have been eliminated. There is no contamination of the material being pumped since rotary parts do not contact the fluid. The self-priming pump operates wet or dry and handles slurries and viscous materials. The close-coupled device measures only 6 by 8 by 11 inches. The OEM pump is offered in capacities from 1/3 to 10 gpm and pressures to 35 psi. Standard materials are high-temperature neoprene for the liner and linear polyethelene for body block. Other materials such as PVC, "Teflon", "Buna N", "Kel F" and "Hypalon" are available on special order.

Vanton Pump & Equipment Corp., Hillside, N. J.

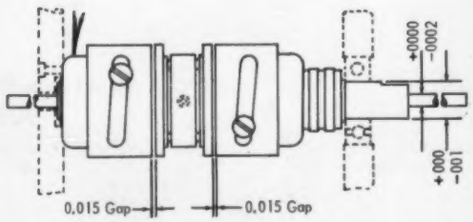


Concealed Latch 303

Releases with Light Pressure to Installed Panel

This latch offers substantial cost savings over ordinary hardware-type latches. Single hole mounting with a common nut eliminates riveting, welding and special tooling for production-line installation. It may be mounted in castings with tapped holes. Light pressure at any point on an access panel will release the panel instantly. Similar pressure closes the panel with positive locking action. One stud design for the majority of applications has been established to reduce inventory requirements.

Camloc Fastener Corp., 52 Spring Valley Rd., Paramus, N. J.

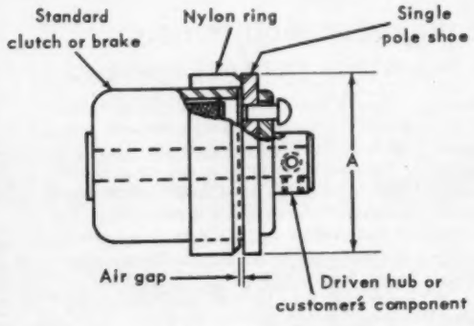


Clutch and Brake Combinations 304

Vary Operating Characteristics

Rotary components utilizing clutches, brakes and continuous slip clutches and brakes in an in-line construction may be consolidated in almost any desired combination to produce a variety of operating characteristics. These combinations allow each half of the set to be selected to conform to the driving or braking needs of equipment, without compromising specifications for the other half, regardless of how divergent specifications for both halves may be. Zero backlash, zero residual drag and complete release are standard on all units. Available in two sizes, torque output is 30 oz-in at 2w power input for Size 100, and 110 oz-in at 3-1/2w for Size 130. The "T" attachment, which converts standard units to continuous slip operation at infinitely variable torque, is employed on slip clutches and brakes. Torque for Size 100 is 0-10 oz-in, and 0-40 oz-in for the Size 130. Standard voltages are 6, 12, 28, 48 and 100v d-c. Any combination of these may be specified for the two halves. Output assembly is so designed that either or both halves of combination may be engaged at the same time.

Dial Products Co., 19 Cottage St., Bayonne, N. J.



IN APPLICATIONS WHERE OUTPUT TORQUE, slip or tension are to be accurately controlled, special attachments are available for various clutch-brake combinations.

NAME YOUR STAINLESS SHAPE!

The design and manufacture of quality stainless steel castings is a specialized job . . . *and Dodge specializes in it!*

There is practically no limit to the variety of shapes we can turn out to meet your simple or intricate specifications precisely . . . economically.

Perhaps one or more DS castings shown here will help spark an idea of how Dodge can be of assistance for *your* stainless steel casting needs. A blueprint or sketch with operational details will bring complete information, without obligation.

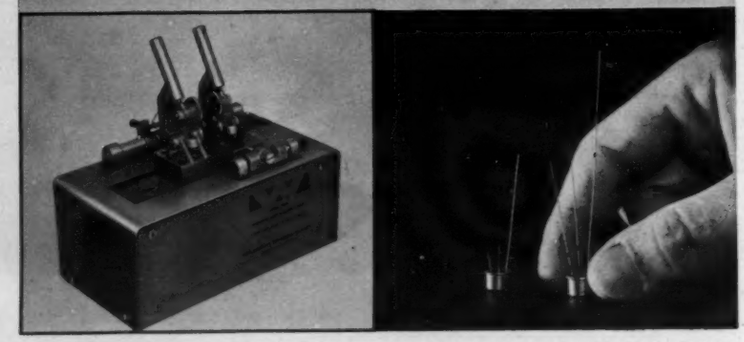
DODGE STEEL COMPANY
6501 State Road
Philadelphia 35, Pa.
• *Phone: DEvonshire 2-2200*

DS DODGE PRODUCTS

THE MOST IMPORTANT ALLOY IN A STAINLESS STEEL CASTING IS QUALITY

Circle 47 on Reader-Service Card for more information

ELECTRONIC
BUTT WELDER



DELIVERS ACCURATE, REPEATABLE END TO END WELDS OF WIRE RANGING FROM .008" TO .040"

Built to handle continuous production line runs, this unit is equally at home on any number of special butt weld situations. For example, use the 1040 to lengthen leads for circuit convenience; salvage short lead components; switch component lead materials; weld different materials for circuit design and convenience. Force setting of up to 10 lbs. and power range of up to 80 watt-seconds allows wide latitude in materials. Easy to operate. Full compliance raceways assure consistent in-line abutment of the workpieces while automatic wire length stops facilitate rapid loading and positioning of parts. Immediate delivery. Ask your local Weldmatic representative for details, or write to us for Bulletin 1040 at 950 Royal Oaks Drive, Monrovia, California.

W61-5

WELDMATIC DIVISION / UNITEK

Circle 48 on Reader-Service Card for more information

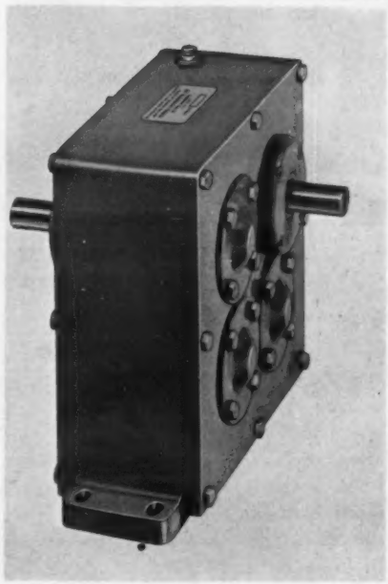
MECHANICAL

Intermittent-Motion Drive

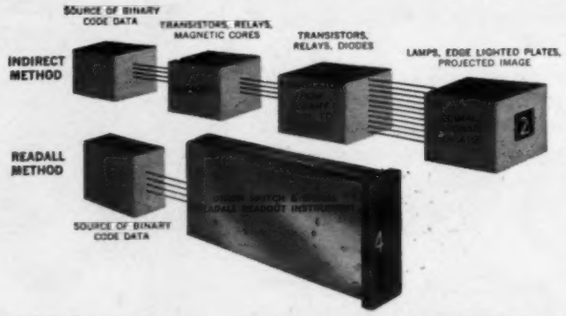
308

This rotary component provides smooth acceleration-deceleration motion and is available in either 40- or 140-deg dwell. The drive can be attached to a variety of packaging equipment, indexing tables, metalworking machines and punch presses. The unit is designed to eliminate shock loads on single-revolution clutches because of its output shaft which makes one complete revolution for each complete revolution of the input shaft. Available in two models, both are square in shape, measuring 9-3/4 inches, with the small model having a thickness of 4-3/8 inches, and the large model a 7-1/8-inch thickness. The shafts protrude approximately 1-3/4 inches beyond the drive case.

Remmele Engineering, Inc., 515 University Ave., St. Paul, Minn.



READALL READOUT NEWS from Union Switch & Signal



READALLS® reduce equipment requirements . . . simplify circuitry in industrial control systems

A comparison of the two methods of displaying information reveals the advantages of READALL Readout Instruments. Method A shows a system which requires the use of complicated conversion equipment to bring about a visual display of desired data. Method B eliminates the need for associated conversion units. The additional equipment required in Method A increases initial equipment costs as well as installation and maintenance costs. Use of READALL Readout Instruments makes it possible to eliminate the "black boxes" ordinarily required for use with more indirect readout methods.

Outstanding features in one small package: Readability of display. Binary decoding. Data storage. Electrical readout.

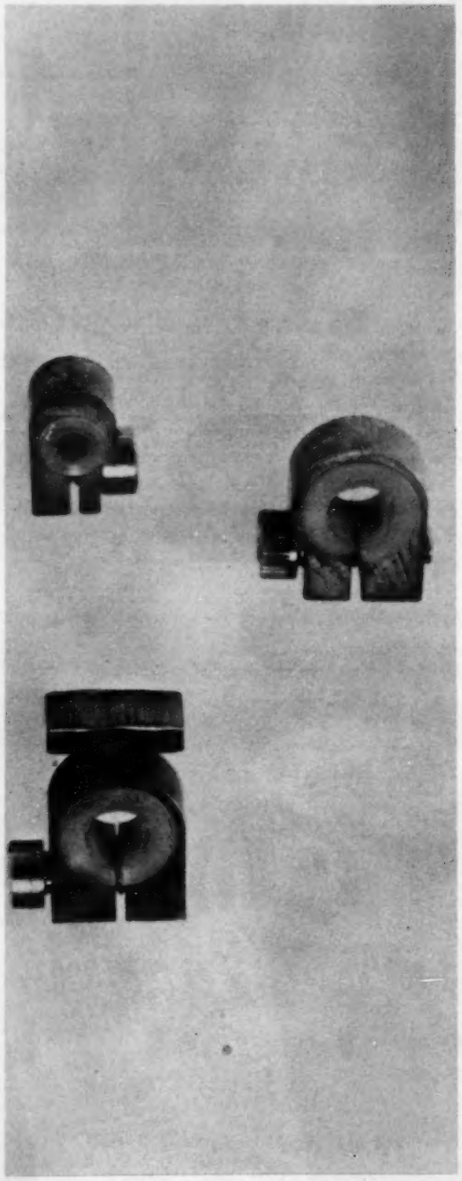
UNION READALL Readout Instruments are available in 10, 12, and 64-character units. Special militarized 12 and 64-character units have been designed specifically for MIL-E-5422D.

Write for Bulletin 1057.

UNION SWITCH & SIGNAL
DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY —
PITTSBURGH 18, PENNSYLVANIA

Circle 49 on Reader-Service Card for more information

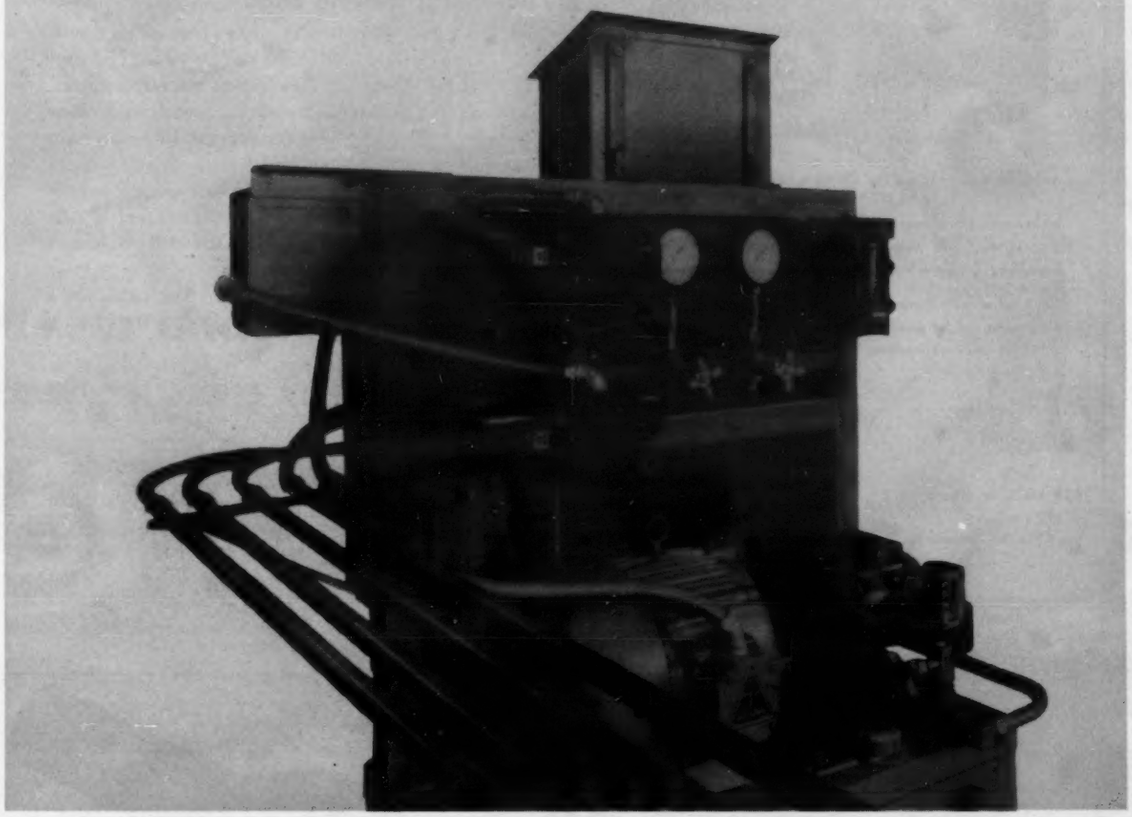
Nylon-Insert Clamp 309



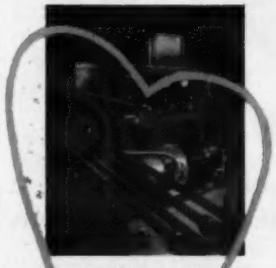
A new component for the electromechanical field is offered in three shaft sizes: 1/8, 1/4 and 3/16 inch. Eighty-five different types cover balanced, unbalanced, gear, hinged, pull and swivel clamps, precision manufactured to 0.001 inch. Apparent advantages include: uniform pressure; shaft and hub marring prevention, and shock-absorbing resiliency.

Sterling Precision Corp., Component Div., 5 Sintsink Dr., Port Washington, L. I., N.Y.

Is hydraulic vibration one of your design problems?



Scans Associates solved this problem with a Racine Hydraulic System



Porosity testing machines manufactured for major Detroit transmission plant by Scans Associates, Livonia, Michigan.

"It would take an Act of Congress to make us use any equipment except Racine components for our porosity testing machines," says Mr. Vernon G. Converse, President of Scans Associates, Livonia, Michigan. The machine — which makes 4 different leakage tests on transmission cases in a 20-second cycle — must check porosity to ¼ inch of water pressure. The machine hydraulically clamps the part firmly in place and tightly plugs all openings. Air pressure and vacuum are alternately applied inside the part, and changes in pressure are pneumatically measured. The slightest hydraulic vibration would distort the readings. "This demands hydraulic equipment that is both extremely sensitive and steady," states Mr. Converse. "Racine has always met both requirements perfectly." The Racine system in this application consists of a Model S variable volume pump, a self-contained 30-gallon reservoir, a 5HP motor and 3 Racine valves (one of them for pressure reduction).

If your application demands sensitivity and precision in hydraulic control, a compact Racine system can meet your requirements.

RACINE HYDRAULICS & MACHINERY, INC. RACINE, WISCONSIN

We're interested in knowing more about Racine Hydraulic Systems. The application of interest to us is _____

NAME _____ TITLE _____

FIRM _____

ADDRESS _____

CITY & ZONE _____ STATE _____

RACINE

RACINE designs systems to solve hydraulic problems

Circle 50 on Reader-Service Card for more information

MAYLINE

DESK-O-MATIC

Tilting Action Completely Balanced!

Adjustable springs on the tilting quadrants of the Mayline Desk-O-Matic and May-O-Matic drafting tables give the draftsman a constant smooth change in angle position of the drafting top, despite any accessories that might have been added to the top edge.

For additional information on this important top tilt control factor, inquire of your local dealer or write to factory. All inquiries answered promptly.

MAYLINE CO., INC.

529 No. Commerce St.

Sheboygan, Wisconsin

MAY-O-MATIC "E" COMBINATION

MAYLINE

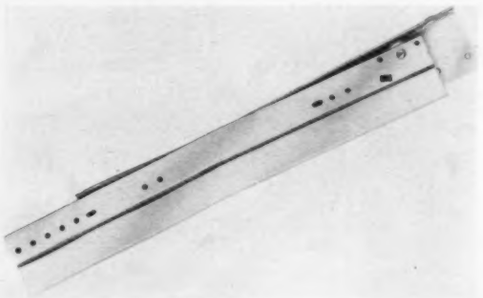
Circle 51 on Reader-Service Card for more information

MECHANICAL

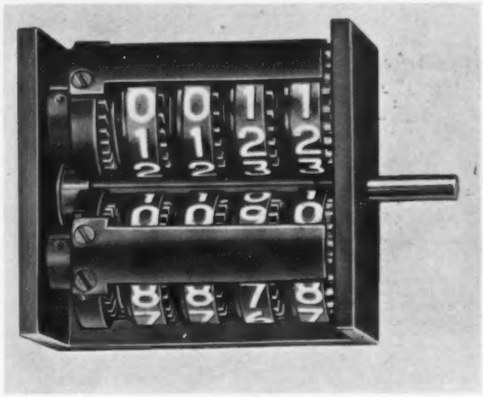
Automatic-Closing Slide 310

The No. 340 "Auto-Slide" requires only a slight push for it to slide by itself into closed position. The unit is recommended for application to refrigerators, washing machines, dishwashers, stoves and other appliances which require the accessibility of certain units. It is available in any length from 14 to 28 inches. It also can be adapted to suit specific length requirements. The unit requires only 1/2 inch of side space and load capacity is rated at 100 lb. Standard finish is bright zinc.

Grant Pulley & Hardware Corp., Appliance Div., High St., West Nyack, N.Y.



Dual Bank Counter 311



This counter is designed for digital readout applications where plus and minus, right and left or directional readings are required. A companion to the "in-line" units, the Model 4-4-Y-9425-R-AC is intended for use in instruments requiring reading lines one above the other. Operation is such that both banks are open for readings at the zero position. When passing zero position, one bank is shuttered and the other bank adds; when reversed through zero position, the shuttered bank opens and the other bank is closed.

Durant Mfg. Co., 1992-IS N. Buffum St., Milwaukee 1, Wis.

"Dyflon"®

Self-Aligning and Self-Lubricating

SPHERICAL BEARINGS

Combine "Monoball"® Engineering Advantages with Life-Time Lubrication

Design engineers in many industries are specifying new "DYFLON"® SELF-ALIGNING and SELF-LUBRICATING SPHERICAL BEARINGS for these 5 major reasons:

1. **LOWER COEFFICIENT OF FRICTION** ...ideal where lubrication is impossible or undesirable.
2. **WITHSTAND EXTREME VIBRATION** ...perfect performance under shock load conditions.
3. **WILL NOT "COLD-FLOW"** ...even under extreme load conditions.
4. **IMPERVIOUS TO KNOWN CHEMICAL SOLVENTS** ...eliminates corrosion problems.
5. **FAIL-SAFE** ...due to "Monoball"® design.

Request Engineering manual No. 551.

In addition, due to their two-piece "MONOBALL"® design and plastic alloy insert, "DYFLON"® bearings have a long cycle life. Alignment and installation problems are minimized. Oil-free for life means lowest possible maintenance costs.

Available in a variety of plain or rod end types. Bore sizes to 3.000". Materials include stainless steel, plastic alloys and chrome alloy steels. Ultimate static loads to 500,000 lbs.

SOUTHWEST PRODUCTS CO. 1705 SO. MOUNTAIN AVE. MONROVIA, CALIF. • PHONE: MURRAY 1-9616

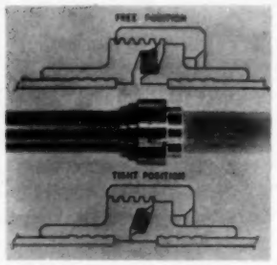
Circle 52 on Reader-Service Card for more information

OFF THE SHELF
SALE!
24¢ MERCURY SWITCHES
MODEL S502B100 IN QUANTITY
Here's high value in a sensitive, genuine General Controls Mercury Switch with unlimited application. Features: Low 5° tilt angle for fast or slow operator, clear glass envelope, wetted electrodes, SPST, 7" plastic coated leads.
MODEL S502B100 SPECIFICATIONS
Length 1.46". Diameter .37"
Electrical Rating: 0.8 amps inductive steady @ 24v A.C.; 20 V.A. @ 115v to 230v A.C.
THE MORE YOU BUY... THE MORE YOU SAVE!
WHILE THE LIMITED INVENTORY LASTS... YOU CAN HAVE GENERAL CONTROLS QUALITY AND COST SAVINGS TOO. STOCK NOW AGAINST FUTURE REQUIREMENTS WHILE THIS SPECIAL OFFER LASTS.
CALL OR WRITE FOR FREE SAMPLE!
CHECK THE YELLOW PAGES FOR YOUR CLOSEST GENERAL CONTROLS FACTORY BRANCH OFFICE.
Automatic Controls for Product or Process
GENERAL CONTROLS
Glendale, Calif. • Skokie, Ill. • Guelph, Ontario, Canada
Nine Plants • 44 Factory Branch Offices Serving the United States, Canada and Western Europe

Circle 53 on Reader-Service Card

High-Temp Coupling 312

An all-metal seal is featured in a new series of cryogenic and high-temperature couplings. Action of the seal will maintain tight joint for all extremes of temperature shock, pressure surge and vibration. Seals are reusable for economy and reversible for foolproof installation. The sealing surfaces do not require special finishes and are not susceptible to damage in handling or service. Greater structural reliability is provided by



mechanically attaching the couplings to tubing. Several configurations are available in aluminum, stainless steel and other materials to accommodate all types of fluids at any desired level of pressure from −425 to 1800F. Sizes range from 1/4 through 3 inches tube dia in JT14 series. Other types in either tube or pipe sizes are also obtainable.

Gamah Corp., 1654 Lincoln Blvd., Santa Monica, Calif.

Circle 54 for Reader Service

Never underestimate the cost-saving advantages of

LAMINUM®

We address this statement to design, tool, production, inspection and assembly engineers . . .

Holding to extremely close tolerances is a costly procedure. You know that. What you may not know is that frequently you can ease up on tolerances without sacrificing a single thousandth of your precise assembly objectives.

How? By using LAMINUM!

LAMINUM is the registered trade name for laminated shims whose layers are completely surface-bonded to look and act like solid metal. The layers are easily p-e-e-l-e-d to bring the shims to any desired thickness—for a thousandth fit right at assembly.

With LAMINUM in the specs, machining operations become less critical, faster and less costly. Inspection is simpler and less costly. The savings carry over to the assembly line, too. No stand-by equipment. No machining. No grinding. No counting, stacking or miking. And no dirt between layers—ever!

Get the facts about cost-saving LAMINUM, and the custom-stamping service that goes with it. They're all illustrated and described in our Shim Design Folder No. 4. Write for it.

THE LAMINATED SHIM COMPANY, INC.

West Coast Sales and Service
600 SIXTEENTH ST., OAKLAND, CALIF.

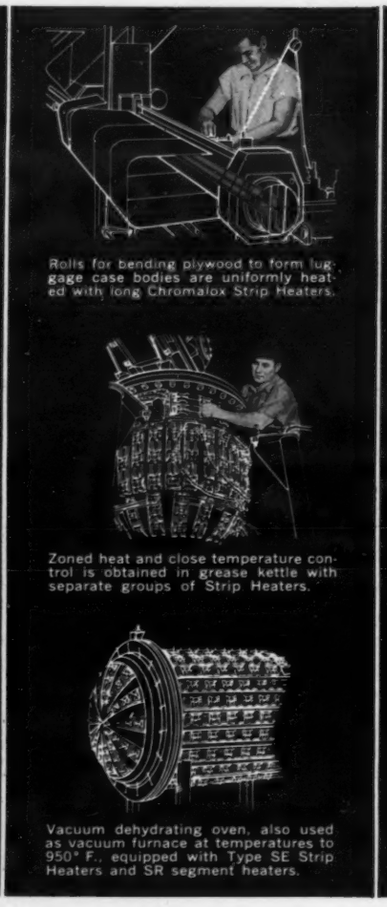
Home Office and Plant
1108 UNION STREET, GLENBROOK, CONN.

BRASS • MILD STEEL • STAINLESS • ALUMINUM • WITH LAMINATIONS .002" OR .003"

CHROMALOX ELECTRIC STRIP HEATERS

Versatile, dependable, uniform heat for your product or processing needs

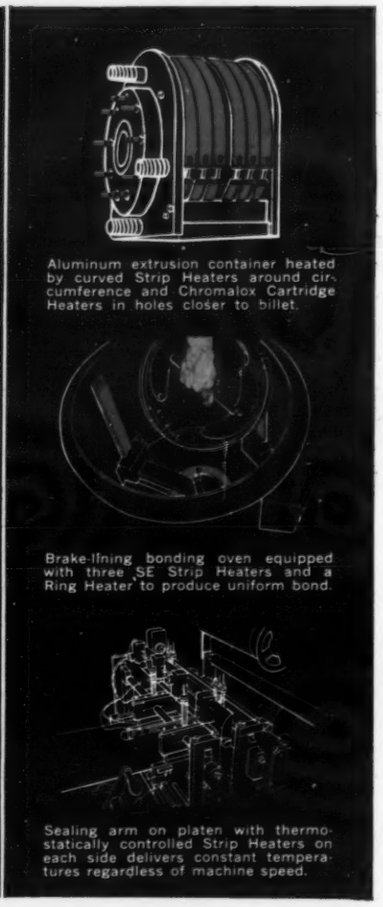
Chromalox Strip Heaters, sheathed in iron, chrome steel and Monel, come in sizes and types for every need. 4" to 96" lengths, 1" to 2½" widths. Also available in full rings and segments.



Rolls for bending plywood to form luggage case bodies are uniformly heated with long Chromalox Strip Heaters.

Zoned heat and close temperature control is obtained in grease kettle with separate groups of Strip Heaters.

Vacuum dehydrating oven, also used as vacuum furnace at temperatures to 950° F., equipped with Type SE Strip Heaters and SR segment heaters.



Aluminum extrusion container heated by curved Strip Heaters around circumference and Chromalox Cartridge Heaters in holes closer to billet.

Brake-lining bonding oven equipped with three SE Strip Heaters and a Ring Heater to produce uniform bond.

Sealing arm on platen with thermostatically controlled Strip Heaters on each side delivers constant temperatures regardless of machine speed.

Compact, metal-sheathed Chromalox Strip Heaters assure accurate temperatures, dependable around-the-clock service anywhere heat is needed for product or process. It is by far the most versatile built-in heat source available today. Easy to install—Chromalox Strip Heaters produce uniform and accurate temperatures with automatic or manual controls.

Low initial cost, low installation costs and low operating costs are among the many other advantages of using Chromalox Strip Heaters for heating tanks, platens, ovens, molds, moving parts, and similar uses. Over 500 standard sizes, shapes, ratings and terminal arrangements available immediately from stock. Get the full details now.

GET THE FACTS
Write for Industrial Processing Catalog 60, Comfort Heating Catalog F-975D, Infrared Catalog G-62.

W1-10

EDWIN L. WIEGAND COMPANY
7561 THOMAS BLVD., PITTSBURGH 8, PA.

CHROMALOX
ELECTRIC HEAT

PROCESS COMFORT

Circle 55 on Reader-Service Card for more information

MECHANICAL

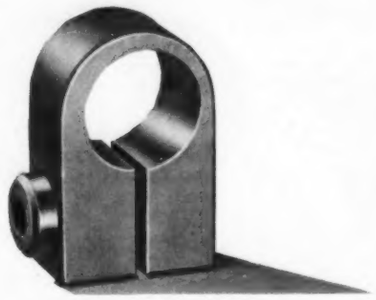
Precision Gearheads 313

Modular internal construction of gearheads and speed reducers permits size reduction while retaining servicing ease and subunit replacement capability. Available in Size 5 to 18 servomounts, reducers and gearheads have precision Class 2 gearing. All units contain ABEC Class 1.5 bearings. The Size 11 unit has 0.001-inch per 1/2-inch

length maximum radial play with an 8-oz load. End play is 0.004-inch maximum with a 1-lb load. Backlash is 30 minutes maximum. Housing is aluminum alloy in green anodize. All other parts are also of noncorrosive materials. Applications include servosystems, analog and digital computers, missile guidance and propulsion systems, and ground support equipment.

Elm Instrument Corp., 30 Chasner St., Hempstead, L. I., N.Y.

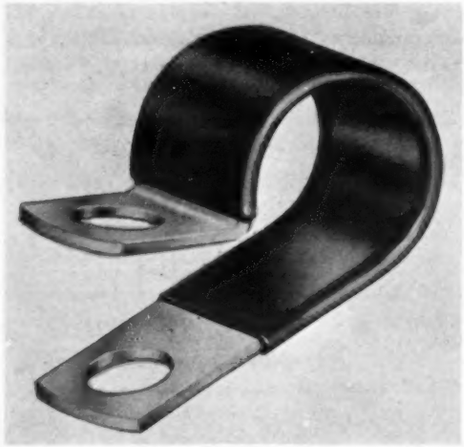
Balanced Gear Clamp 314



More than 150 types of instrument clamps for the electromechanical equipment industry are manufactured for the purpose of locking in place subminiature components in computers, gear trains and other instruments. Clamps are made to precision tolerances of +0.001 and are available in shaft sizes of 1/8, 1/4, 3/16 and 5/16 inch. The new component pictured is a subminiature balanced-type gear clamp with 1/8-inch bore size. Other sizes are offered in the same configuration.

Siamco Div. of Tech-Ohm Electronics, Inc., Long Island City, N.Y.

Neoprene-Coated Cable Clamp 315



Low-cost aluminum clamps feature a flame-resistant neoprene cushion offering a high friction coefficient to hold cord or tubing with a positive nonsliding grip, preventing any strain on connections. Because of its cushioning action, cutting and scraping of cord insulation are minimized. Neoprene is oil resistant and will maintain its natural qualities over a wide temperature range. Clamps are available in sizes for 1/8 to 2-inch cable in 1/16-inch increments.

Richco Plastic Co., Dept. DN-1, 3722 W. North Ave., Chicago 47, Ill.

5000 psi; 1¼" -2"; 2, 3 and 4-way; 2 and 3-position; optional sub-plate mounting
5000 psi; ½" -2"; 2, 3 and 4-way; 2 and 3-position optional sub-plate mounting
5000 psi; 2" -4"; 3 and 4-way; 3-position
2000 psi; ½" -1"; 2, 3 and 4-way; 2 and 3-position

for water or oil service

HUNT *Hydraulic Valves*

zero leakage • shock-reducing operation • sizes from ½"-8" • pressures to 5000 psi

If you're designing or operating hydraulic systems requiring valving of *raw* water, soluble oil and water, or oil, and if you're interested in precise control, positive shut-off, reduction of shock and hammer, plus years of trouble-free operation . . . you'll find it worthwhile to investigate Hunt's complete line of hydraulic valves, featuring *resilient U-packers*. The higher the pressure, the tighter the seal!

You'll have a choice of 3 pressure ranges, 2000, 3500 and 5000 psi . . . a choice of sizes from ½ through 8 inches . . . a choice of manual lever or remote pilot actuation . . . a choice of types — 2-way, 3 and 4-way, 2 or 3-position . . . a choice of steel or high tensile cast or forged brass bodies and direct or sub-plate mounting in many sizes. You'll even find double check types, capable of withstanding pressure in both directions without external check valves, ideal for hydrostatic testing of tubes, pressure vessels and similar items.

Take advantage of Hunt's years of experience in hydraulic control. Call in your Hunt representative for recommendations today.

For more information, write for Bulletin 604. Address Hunt Valve Company, Salem, Ohio, Dept. DN-861.

HUNT

QUICK-AS-WINK© AIR AND HYDRAULIC

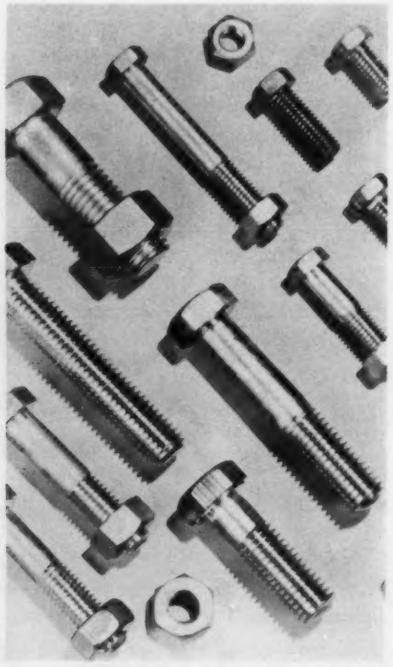
VALVES

HUNT VALVE COMPANY • DIVISION OF IDEC • SALEM, OHIO

Circle 56 on Reader-Service Card for more information

Silicon-Bronze Fasteners 316

An expanded line of aluminum, silicon-bronze and stainless-steel fasteners complements the existing line of steel and nonmetallic fastening devices. These materials meet requirements for high corrosion resistance, high strength-to-weight ratio and light weight needed in many modern applications. Aluminum hex screws from 2024-T4 alloy and hex nuts from 6061-T6 alloy are carried in stock



from 1/4 through 3/4-inch dia. No. 10 and 1/4-inch open-end acorn and acorn locknuts are also available. Extensive stocks of silicon-bronze hex nuts, heavy nuts and hex screws through 3/4-inch dia now are maintained. Stainless hex screws and nuts are manufactured from Type 305 alloy up to 3/4-inch dia in lengths to 9 inches.

Russell, Burdsall & Ward Bolt & Nut Co., Dept. SP, 104 Midland Ave., Port Chester, N.Y.

TO INSURE SUCCESSFUL PERFORMANCE

EVERY GRAMIX® PART IS

(PRODUCTS OF POWDER METALLURGY)

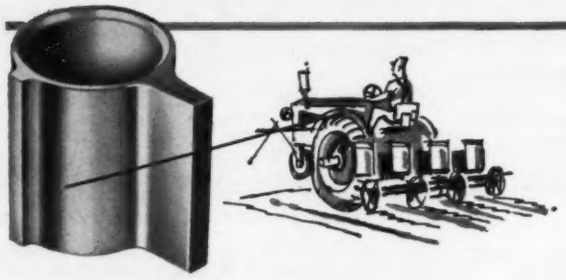
APPLICATION ENGINEERED

One of the most important factors to consider when purchasing powder metal parts is that of successful part performance; for a part to successfully perform its job, all of its physical and metallurgical characteristics must be suited to the application.

GRAMIX Products of Powder Metallurgy are always *Application Engineered,* which means product is specially matched to each specific application. From an almost unlimited variety of metal mixtures, one alloy is blended that contains the required properties and characteristics of the finished part; *all* aspects of part design and conditions under which it must operate are taken into account. Only then is the GRAMIX part produced.

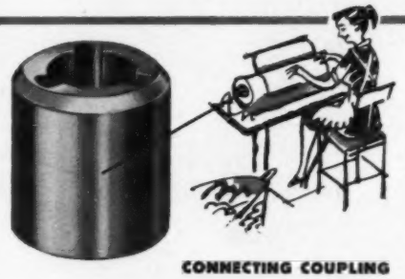
Eight of these *Application Engineered* GRAMIX parts are shown here. Each precisely suits the requirements of its job . . . each is the best part available for the job.

When you specify a GRAMIX part, you can always be sure that it has been *Application Engineered* for successful performance, long life and complete reliability. For more information on *Application Engineered* GRAMIX parts, write for Engineering Handbook G-55.



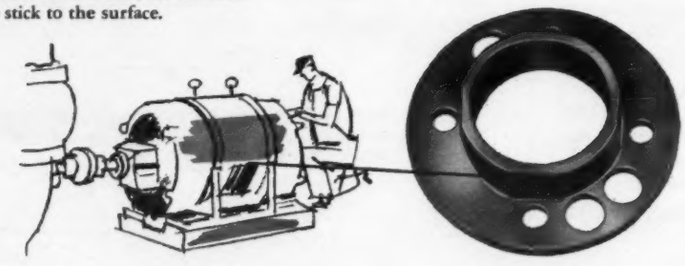
CORN SEEDER

GRAMIX was the material specified for this corn seeder part because the surface finish obtainable with the alloy used reduced the tendency of material to stick to the surface.



CONNECTING COUPLING

The connecting coupling employed in a small home ironer is formed from a special GRAMIX hardened steel alloy; it offers low wear and shock resistance.



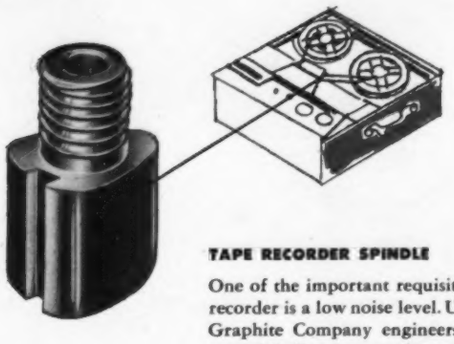
CONTAINER COVER END CAP

Great savings were realized when retainer caps for certain types of electric motors were made of GRAMIX.

This process made it simple and economical to mold the multiple holes to precise tolerances without extra operations.

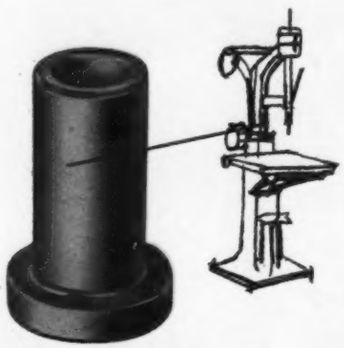
HELICOPTER THRUST WASHER

The outstanding features of the GRAMIX alloy specified for this thrust washer are a dependable and consistent friction and wear pattern as well as a fine surface finish.



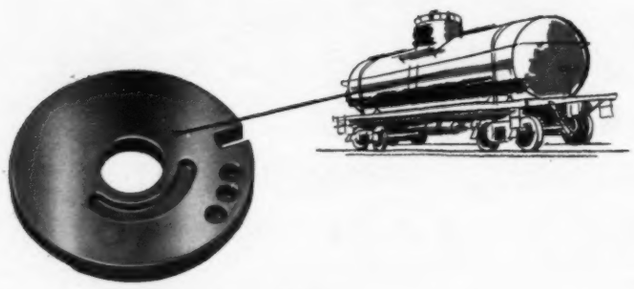
TAPE RECORDER SPINDLE

One of the important requisites in a tape recorder is a low noise level. United States Graphite Company engineers developed a special alloy to meet these requirements in the GRAMIX spindle.



GUIDE BEARING

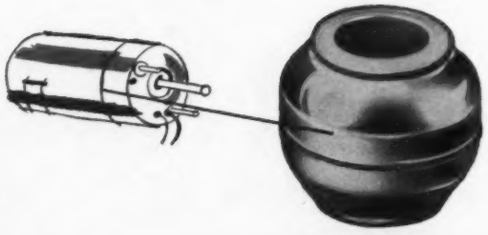
Built-in lubrication and low friction to reduce heat are important features of the GRAMIX alloy chosen for this guide bearing.



LIQUID PUMP END PLATE

This end plate is typical of many parts employed in liquid pumps of many types.

It is made from a wear resistant bronze alloy that was developed for pump applications.



FRACTIONAL H.P. MOTOR

The GRAMIX bearing for this Fractional h.p. motor was developed from a special low noise level alloy.

Its self-lubricating properties were also an important consideration in specifying GRAMIX.

METAL POWDER mpi INDUSTRIES FEDERATION

X-296-2

THE UNITED STATES GRAPHITE COMPANY

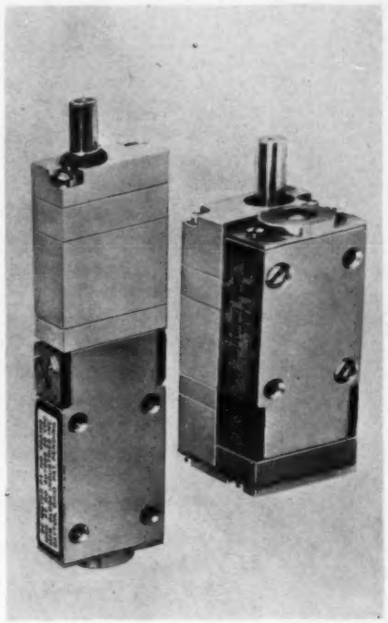
DIVISION OF THE WICKES CORPORATION, SAGINAW 2, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDER METALLURGY • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

Circle 57 on Reader-Service Card for more information

Miniature Gearmotors 317

Permanent-magnet gearmotors provide up to 35 oz-in torque continuous duty, in a package with a frontal area as small as 4/10 sq in. Two configurations of the Type VS are available. The end-mounted reducer provides 62 ratios from 7.88:1 to 25,573.65:1. The side-mounted unit provides a choice of 27 ratios from 26.93:1 to 2511.84:1. The end-mounted reducer/motor is 7/16 by 7/8 by 3-3/4 inches maximum length, depending on ratio chosen. Typical weight is 2.5 oz. Side-mounted reducer/motor is 7/8 by 7/8 by 2-1/4 inches long and typical weight is 2.5 oz. Spur gear system uses case-hardened gears on hardened stainless-steel shaft. Units are designed to meet appropriate military specifications. Standard motor has 13 armatures for up to 50v d-c. Motor rating is 0.0025 hp at 8000 to 17,000 rpm.



Globe Industries, Inc., 1784 Stanley Ave., Dayton 4, Ohio.

NOW, buy only the horsepower you need with
REULAND'S new Hydraulic Pump Motor Intermediate* H.P. Ratings!

Tailor motor h.p. to your pump's performance curve.
Reduce motor costs... increase operating efficiency.

If you're an O.E.M. or user of hydraulic pumps, Reuland's twelve new "in-between" hydraulic pump motor ratings can start saving you money as of *today*. No longer must you pay for overmotoring... no longer must you compromise operating efficiency with an unneeded, over-size motor. *Now you pay by the horsepower... and buy only what you actually need to match the performance curve of the pump!*

Reuland's new intermediate ratings are an important sequel to *another* famous Reuland first... the original, internal spline coupling method of hooking up motor and pump!

All ratings are standard and available for quick deliveries. New price lists and engineering data sent on request. You should have a copy.

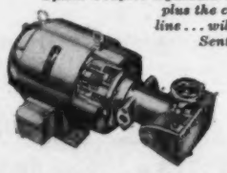
Refer to Sweet's 1961 Product Design File, 7a/RE

28 horsepower ratings from ½ through 60... 12 brand new, exclusive, intermediate ratings!

½	¾	1	1½	2	2½*	3
4*	5	6¼*	7½	8¾*	10	12½*
15	17½*	20	22½*	25	27½*	30
32½*	35*	37½*	40	45*	50	60

*Exclusive, new intermediate ratings.

Your copy of this catalog on Reuland Spline Coupled Hydraulic Pump Motors... plus the complete Reuland line... will come in handy. Sent free on request.



MODERN POWER FOR MODERN-DAY PRODUCTS
... all in lightweight, cool-running aluminum frames!

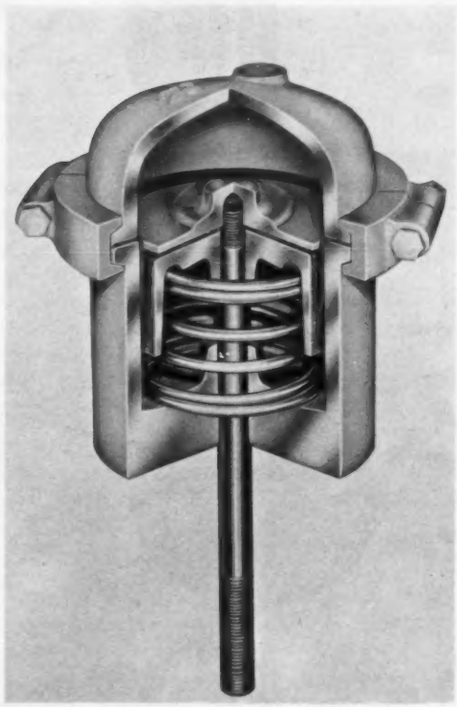
REULAND MOTORS

REULAND ELECTRIC COMPANY
Western Division: Alhambra, California
Eastern Division: Howell, Michigan
Distributors in all principal cities

Circle 58 on Reader-Service Card for more information

Diaphragm Actuators 318

The "Rollomotor" is an air-operated, rolling diaphragm actuator which gives fast response to small changes in air pressure: it has a long stroke with a smaller-diameter piston than flat or convoluted diaphragm motors. Applications are for sliding stem operation of valves, rheostats, speed reducers and other equipment which can be controlled by a reciprocating motion. Use of the rolling diaphragm allows long strokes up to 12 inches, high operating pressures and the use of smaller-diameter pistons than normally are used. Four



types are obtainable: air-to-close, spring-to-open (normally open); air-to-open, trapped-air-to-close (normally closed); air-to-close with positioner (normally open), and air-to-open with positioner (normally closed). Each type is available in a full range of sizes. Air-to-open types are furnished with a check valve and a 0-100 psi gage. Air-to-open types with positioners are furnished with pressure reducing valve, check valve and gage.

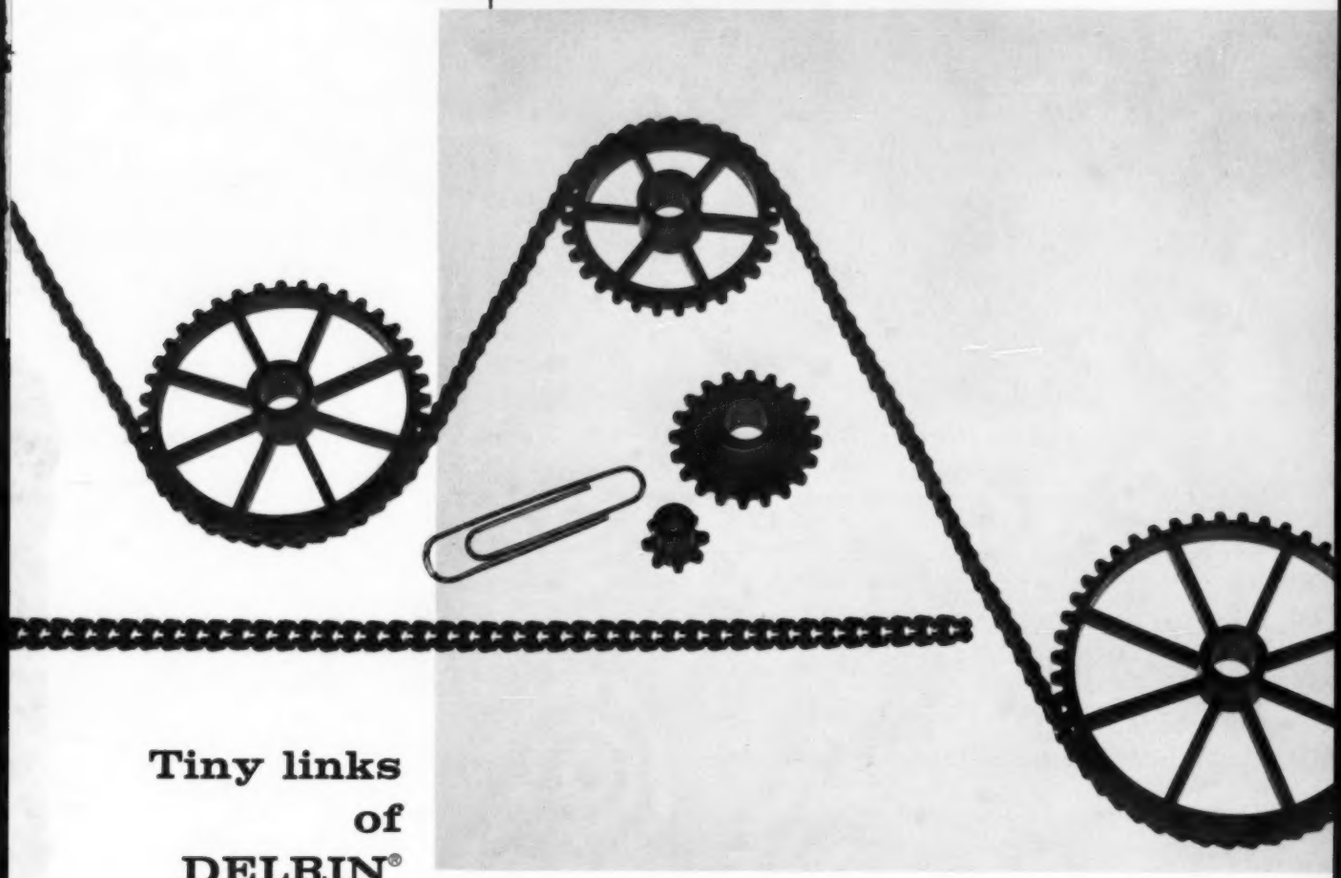
RKL Controls, Inc., Hainesport, N.J.

Circle 59 on Reader-Service Card

working with

Du Pont Delrin

one of Du Pont's versatile engineering materials



Tiny links of DELRIN® make a remarkable miniature chain

These miniature chains and sprockets are significant examples of the way Du Pont DELRIN acetal resin provides superior performance in application areas once reserved for metals. The chain of snap-fit links is made possible by the strength, stiffness and resilience of DELRIN. The need for a master link is, therefore, eliminated, making the chain adjustable in ⅛ inch increments. The chain weighs only 1 oz. per 15 ft.—one-fifth the weight of similar steel chain. It is factory-tested; momentary tension load at 7 lbs.; and running loads to 2 lbs. Manufacturer's service-life tests show a work rate transfer of 0.06 HP for 10 hours . . . 50 foot-tons of work per inch of chain. The chain is solvent-resistant, prelubricated, non-magnetic and non-conductive. These drive components were designed to fill a need in miniature mechanics and instrumentation in a wide variety of high-speed, low-inertia mechanisms.

The manufacturer, Bohannon Industries of Colorado Springs, Col., reports that of the many materials tested, only DELRIN was adaptable to the intricate technology involved in the development of these miniature drive components.

The unique combination of properties offered by DELRIN solve a variety of design problems in areas as diverse as automobile handles and electronic switches. On the reverse side, you will find additional examples of product improvements made possible by this versatile material.

DU PONT

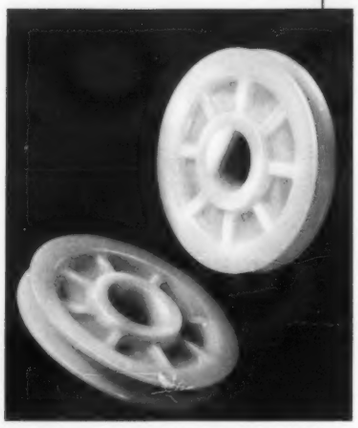
REG U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING THROUGH CHEMISTRY

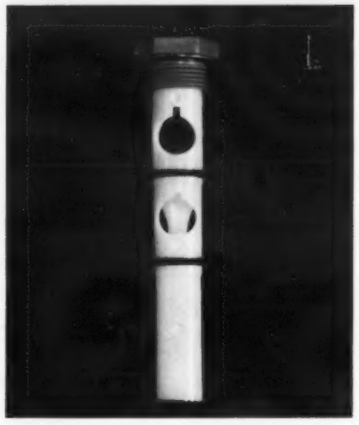
working with

Du Pont Delrin®

one of Du Pont's versatile engineering materials



Long-wearing parking-brake cable pulleys of DELRIN® are being used by a leading car manufacturer. The full-radius groove in DELRIN provides natural mating, maximum contact area with the cable . . . eliminates the cable pinching caused by split-type steel pulleys. The new pulleys molded of DELRIN have been tested under severe long-term conditions of high load and temperatures.



Jet injector unit for shallow-well system is molded in three parts of DELRIN and joined by two "one-direction" snap-fits, giving permanent assembly. The new unit outwears bronze by a factor of 2 under sand abrasion . . . molded threads utilize high shear strength of DELRIN acetal resin. (Molded by American Molding Company, San Leandro, for Jacuzzi Bros., Inc., Richmond, California.)

Thumbwheel of this unique multi-deck rotary switch is molded of tough, abrasion-resistant Du Pont DELRIN. A single ¼ inch thumbwheel of DELRIN provides the mechanical and electrical insulating properties needed to handle a combination of rotary switches. (Molded by Par-A-Mount Tool & Mfg. Co., Inc., Chesterton, Indiana, for Chicago Dynamic Industries, Precision Products Division, Chicago, Ill.)

DELRIN® has the strength and toughness to meet rugged mechanical requirements

When a part must function reliably under rugged usage, the strength, stiffness and toughness of DELRIN acetal resin may well provide an economical solution. Parts molded of DELRIN retain a high degree of their mechanical properties under numerous conditions, including broad temperature ranges (–40°F. to 250°F.), humidity, solvents and stress.

Already, many hundreds of designs taking advantage of the unique properties of DELRIN, and of the cost savings made possible by rapid injection molding, have been put into commercial production. Why not investigate further with a view to your own products and problems? Mail the coupon below for more information.

POLYCHEMICALS DEPARTMENT

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.), Dept. 2
Room 2507D Nemours Building, Wilmington 98, Delaware
I am interested in evaluating DELRIN® for the following use:

A
B
C
D

*Name*_____

*Company*_____ *Position*_____

*Street*_____

*City*_____ *Zone*____ *State*_____

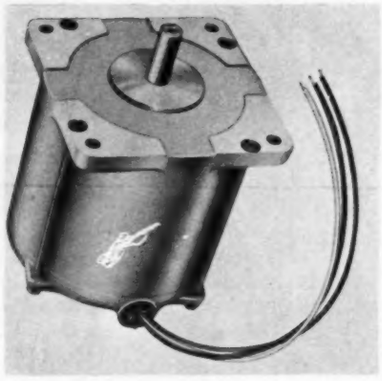
In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

DELRIN® *acetal resins*
one of Du Pont's versatile engineering materials

Alathon® · Zytel® · Lucite®

Synchronous Motor 319

The Type X1000 synchronous motor is suited for "on-off" a-c servo applications where a 72-rpm speed and 1000 oz-in torque are required. The rotary component can be started, stopped or reversed instantly with a single-pole, three-position switch. If desired, output shaft can be stepped at 200 precise steps per revolution by using a d-c power supply with appropriate switching. Ratings are: input,

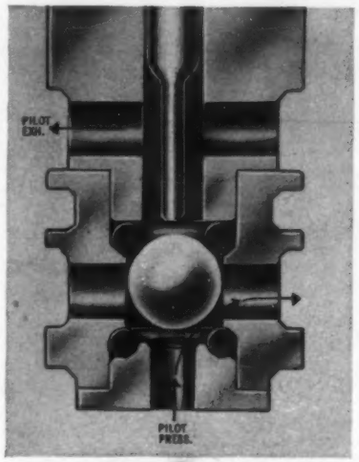


120v, 50/60 cycle, one-phase, 3.0-amp maximum current (at 60 cycles); 72-rpm output speed at 60 cycles; 100 oz-in torque. Weight is 22 lb. Built to conform with Class 1, Group D explosion proof specifications, the device can be used for remotely controlling gate and butterfly valves, machine-tool carriage feeds, numerical positioning control systems and other automated industrial applications.

Superior Electric Co., Dept. X1000, Bristol, Conn.

Circle 59 on Reader-Service Card

How To Build An Air Valve That Beats Friction and Coil Heat



ENLARGED SECTION OF PILOT CARTRIDGE

To Achieve Endurance, a Breakthrough in Speed

Generally, the most unpredictable factor in solenoid valve life is the solenoid coil itself, and yet, a solenoid can be made to last practically forever if the coil can be kept from overheating. Coil heat is generated by long plunger travel and accelerated by erratic drag (friction) during that travel. Achieve a short, quick, sure plunger stroke and the coil will last indefinitely. Therefore, the life of a solenoid pilot air valve is directly related to speed of operation. To achieve operating speed, friction in the pilot section and solenoid plunger travel must be reduced to a minimum. Solve these problems and you get air control reliability that seems to have no limit.

The Call-Outs Tell the Story of Endurance

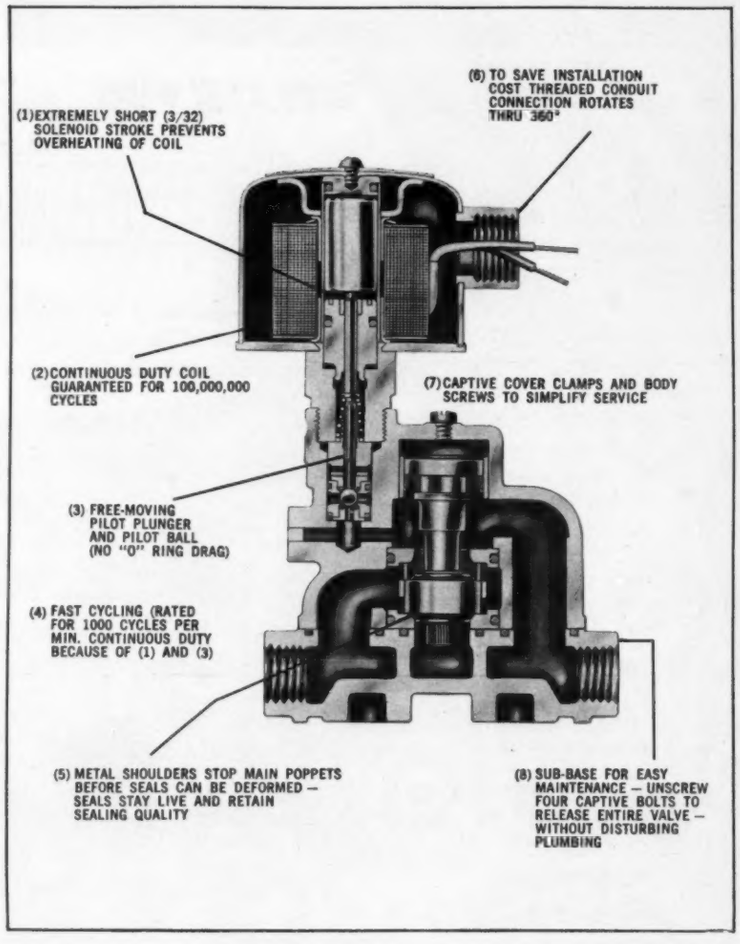
To control the major source of coil burnout, coil heating, the stroke of the solenoid plunger must be reduced to a minimum. The short stroke fractions the time the coil is energized; heat generation drops and response time of the valve is stepped up. In the "Mach 2" the stroke has been reduced to 3/32—about the thickness of a nickel. Furthermore, the friction problem must be solved, to avoid any unpredictable drag. In the "Mach 2" this has been done by use of a pilot cartridge enclosing a free-moving ball that seats on "O" rings at both ends of the cartridge [see above]. The ball moves freely, independent of the seals. There is no "O" ring drag on the pilot plunger as it requires no seals. When there is no friction there is no wear. Similarly, the main valve seats seal on "O" rings. In the sealed position, metal shoulders take the shock in such a way that the "O" ring seal is merely kissed by the main valve seat [see (5) below]. As the rings are only minutely flexed they do not fatigue or lose their resilience.

What about Cycling Speed?

Short solenoid plunger stroke and elimination of friction make extremely fast cycling feasible. After exhaustive testing in the laboratory and on industrial applications for over six years the "Mach 2" is rated at 1000 cycles per minute continuous duty. Cycling speeds as high as 2100 have been successfully reached for intermittent periods of twenty minutes. During a two-hour test at a sustained speed of over 1500 cycles per minute the coil temperature stabilized at 7°C below the maximum code limit for Class A coils.

100-Million-Cycle Guarantee on Solenoid Coils

The design advances incorporated in the CRESCENT® "Mach 2" Air Valve are a significant breakthrough in both cycling speed and operating dependability. Put CRESCENT® "Mach 2's" (¼- to ¾-inch pipe sizes) on your "valve killer" jobs and see how freedom from coil burnout helps to cut operating costs. Write for an advance copy of the new CRESCENT® "Mach 2" catalog to Barksdale Valves, 5125 Alcoa Avenue, Los Angeles 58, Calif.


(1) EXTREMELY SHORT (3/32) SOLENOID STROKE PREVENTS OVERHEATING OF COIL
(6) TO SAVE INSTALLATION COST THREADED CONDUIT CONNECTION ROTATES THRU 360°
(2) CONTINUOUS DUTY COIL GUARANTEED FOR 100,000,000 CYCLES
(7) CAPTIVE COVER CLAMPS AND BODY SCREWS TO SIMPLIFY SERVICE
(3) FREE-MOVING PILOT PLUNGER AND PILOT BALL (NO "O" RING DRAG)
(4) FAST CYCLING (RATED FOR 1000 CYCLES PER MIN. CONTINUOUS DUTY BECAUSE OF (1) AND (3)
(5) METAL SHOULDERS STOP MAIN POPPETS BEFORE SEALS CAN BE DEFORMED — SEALS STAY LIVE AND RETAIN SEALING QUALITY
(8) SUB-BASE FOR EASY MAINTENANCE — UNSCREW FOUR CAPTIVE BOLTS TO RELEASE ENTIRE VALVE — WITHOUT DISTURBING PLUMBING

Circle 60 on Reader-Service Card for more information

the secret of Ford's swing-away wheel

The secret of the new swing-away steering wheel in the Ford Thunderbird is a flexible shaft between the stub shaft in the steering gear box and the upper steering rod.

Here are the benefits derived from flexible shafts:

1. *Safety*. Safety against failures is provided.
2. *Durability*. Flexible shafts eliminate the possibility of play or lost motion at this juncture for the life of the car.
3. *Compact*. The flexible shaft is more compact than conventional joints.
4. *Strength*. In case of power steering failure, the maximum torque would be 660 pound-inches, which would occur during parking on dry pavement. The flexible shaft can absorb this and *much more*.

Here is another example of creative engineering with flexible shafts. Investigate for yourself how they can solve many of your design problems and at the same time reduce costs.

S. S. WHITE INDUSTRIAL DIVISION,
DEPT. D 10 East 40th Street, N. Y. 17, N. Y.

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FIRST NAME
IN FLEXIBLE SHAFTS

1164

Circle 61 on Reader-Service Card for more information

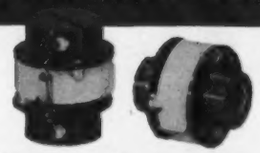
Hydraulic Hose Assembly 320

A new rubber-hose assembly, designed specifically for hydraulic applications, features "progressive swaged" end fittings for maximum reliability. Non skive hose lengthens assembly life. Two performance ratings are offered: medium-pressure hose assemblies for operating pressures up to 3000 psi; and high-pressure assemblies for pressures up to 5000 psi. Complete assembly may be ordered, or designer may obtain bulk hose, fittings and a swaging tool with interchangeable dies for various sizes of hose.

Titeflex, Inc., 603 Hendee St., Springfield 4, Mass.

TIC OF ACTON

MINIATURE FLEXIBLE COUPLINGS

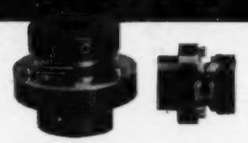


FEATURE • No Backlash • Compactness and Lightweight • Accommodate both lateral and angular misalignment • Choice of types offer clamping or set-screw hubs

Type MPC-1 consists of two flanged aluminum hubs and nylon or Delrin discs with V-grooves that are displaced 90° with each other. Discs are fastened with stainless steel springs loading ball pivots against V-grooves. Dimensions ⅞ x ⅞ in.
Type MPC-2 has two cylindrical aluminum hubs, each with two ball pivots attached. Hubs are attached to a pair of flexible phosphor bronze discs which hold and load the ball pivots. Dimensions ¾ x ½ in. Both types have range of bores to accept shafts from .120" to .250" and meet MIL-E-4970 and withstand −80° to 200°F and shock to 100 G.

TIC OF ACTON

ADJUSTABLE SLIP CLUTCHES



FEATURE • Adjustment over a wide torque range • Compactness and lightweight

Type ASC-1 is ⅞ x 1"
Type ASC-2 Miniature is ⅝" x ⅝"
Both are constructed of aluminum hubs, Delrin® on stainless steel clutch plates and stainless steel hardware. These rugged, high performance clutches are friction units to protect components against excessive or inertia shock loads. Range of bores to accept shafts from .120" to .250". These clutches meet MIL-E-4970 specs.

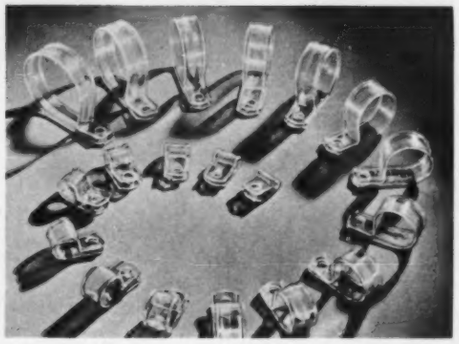
For details on couplings or clutches write

TIC
For further information write
TECHNOLOGY INSTRUMENT CORP.
533 MAIN STREET, ACTON, MASS.
8530 WILSHIRE BLVD.
BEVERLY HILLS, CALIF.

Visit us at Booth #1506-7-8 at the Wescon Show

Circle 62 on Reader-Service Card

Cable Clamps 321



Type 6B "Butyrate" cable clamps provide good support and long life to wires and cable with continuous exposure to sunlight, moisture, industrial atmospheres and temperature extremes. The formula used in the clamps is approved under military specification L-P-349a, Type III—Class MH. Clamps are available from stock in clear color for wire sizes from 1/8 to 1-1/2 inches.

Weckesser Co., Inc., Dept. DN-1, 5701 Northwest Highway, Chicago 46, Ill.

Retaining Fastener 322

This bearing retainer nut is useful for any shaft application where a fastener holds a bearing. When the nut is engaged with the shaft threads, a nylon pellet embedded in the threaded area of the nut exerts a cross-thrust against threads opposite pellet. The result is a tight metal-to-metal engagement, creating a permanent locking and adjusting force. While eliminating the need for tab washers, the bearing retainer also eliminates the necessity of milling a keyway on the shaft and does not necessitate use of the special spanner-grooved nuts which must be used with tab washers. Since the unit holds exactly the desired preload, the bearing nut eliminates excessive bearing wear. It also can be removed and reused many times without loss of locking action. Lock nuts are available in any standard or special alloy and in all thread sizes.

Nylok Corp., 611 Industrial Ave., Paramus, N. J.

When you specify

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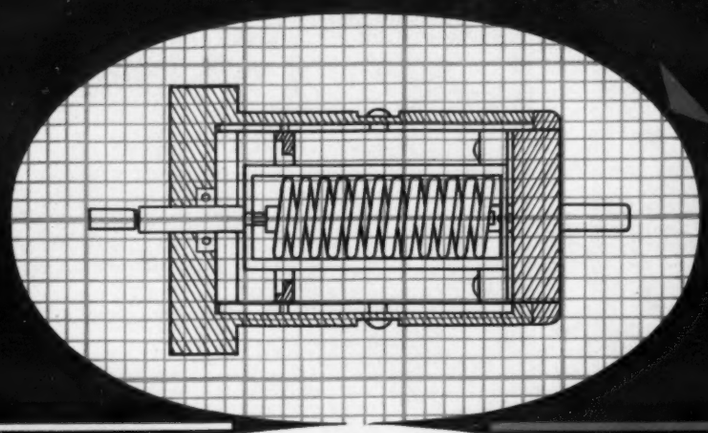

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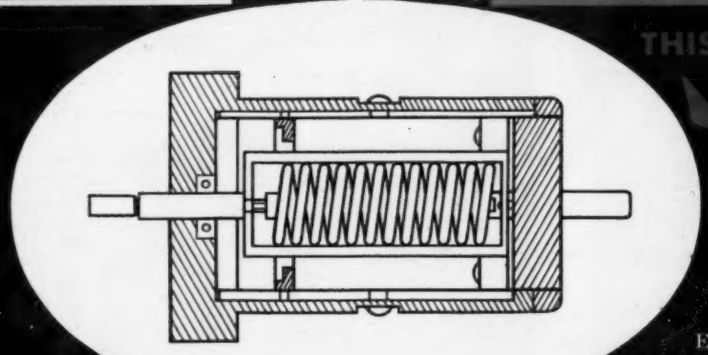

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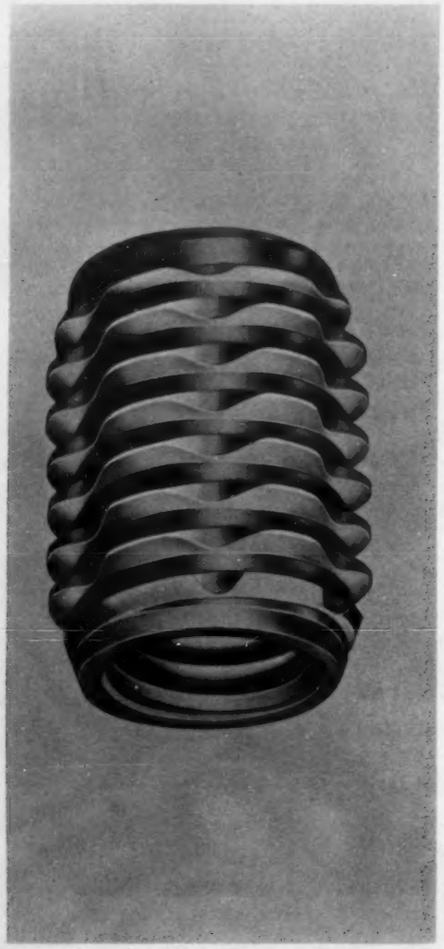
Self-Tapping Inserts 323



"No-Chip" inserts offer low-cost, speedy installation of strong threads in plastics, aluminum and magnesium alloys and other relatively soft materials. Threads, extending the entire length of the insert except for end chamfers, roll their way with a zero tolerance fit through the base material without cutting. This action prevents the formation of chips. Because of the wave crest of the thread, the base material is pushed back gently and then returns behind the wave crest to lock the inserts. "SpeedSerts" are provided with chamfers at both ends, allowing easy installation from either end. The units are made of case-hardened carbon steel, cadmium-plated, sizes 4-40 (SP 0440) through 1/4 (SP 420 or SP 428).

SpeedSerts, Inc., 6500 Avalon Blvd., Los Angeles 3, Calif.

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METALS & CONTROLS INC.,
1208 Forest Street, Attleboro, Mass.

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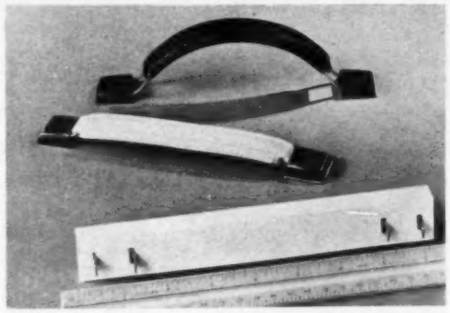
TEXAS INSTRUMENTS INCORPORATED

Lightweight Solenoid 324

Continuous operation at 225F ambient air temperature and a force of 1.3 lb are design features of the new 400C a-c "silent" solenoid. Stroke of the MIL-S-4040-qualified unit is 0.025 inch. The component measures approximately 1.375 by 1.453 inches and requires 108/121v a-c at 380/420 cycles. The unit incorporates a relief-valve mechanism which opens at 21 psi and has zero leakage from 0 to 15 psi.

Rocker Solenoid Co., 140 N. Marine Ave., Wilmington, Calif.

Vinyl Handle Assemblies 325



A chamber of air is sealed into a soft vinyl handle to provide more comfort to the user. Strength is furnished by a concealed steel core which is double-riveted to end rings. Hardware of steel or solid brass is available in any of 20 finishes. Six-inch handle, with an overall assembly length of 8 inches, is shipped preassembled. This enables quick placement of the assembly into prepunched slots in portable case. Assembly fastens either by bending prongs on underside of mounting surface or by snap-on clips which lock into notches on prongs. Standard colors are black, antique white and suntan. Samples, prices and literature may be obtained.

Philadelphia Handle Co., 1643 Haddon Ave., Camden 3, N. J.

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The road leading to a new product may be filled with detours where conventional magnets are concerned. That's where Stackpole Ceramagnet permanent magnets warrant prompt and serious consideration. By providing important characteristics, to extents unobtainable in metallic units, they pave the way to many new and unusual design and engineering approaches.

Ceramagnet's high coercive force permits use without keepers or pole pieces, with many poles on a single flat face, and under other conditions which would quickly demagnetize ordinary units. Moreover, Ceramagnet is chemically inert, electrically nonconductive. Molded from ceramic powders, Ceramagnet permanent magnets can readily be produced economically to practically any size or shape.

For ideas and technical data, write for Ceramagnet Bulletin, Stackpole Carbon Company, St. Marys, Pa.

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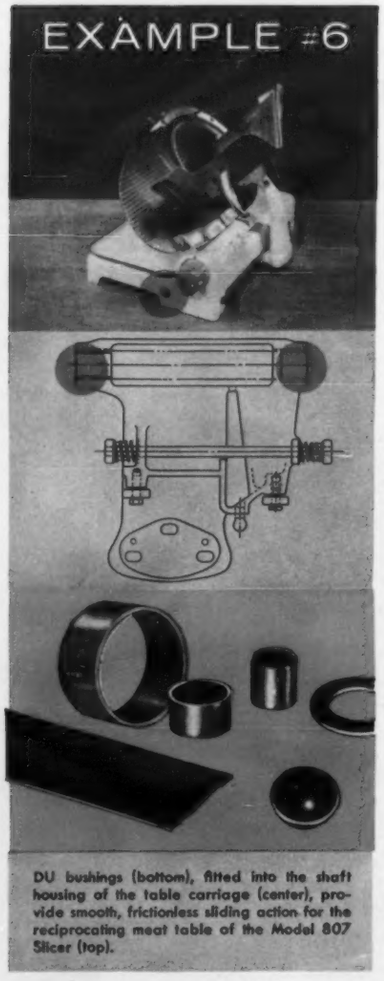

DU bushings (bottom), fitted into the shaft housing of the table carriage (center), provide smooth, frictionless sliding action for the reciprocating meat table of the Model 807 Slicer (top).

DU* DRY BEARINGS Solve Another Problem

"The meat table of the Model 807 Gravity-Feed Slicer is guided by a combination of twin rollers and a round slide bar for reciprocating action. The use of DU Dry Bushings, due to their low coefficient of friction, has solved the problem of providing a table with exceptionally smooth operating qualities."

Paul H. Meyer
Project Engineer
U.S. Slicing Machine Co., Inc.

The switch to DU bushings, in place of bronze, has given U.S. Slicing Machine Company an easier operating slicer, with complaints practically eliminated. DU bushings have proved to operate smoothly at an average bearing load of 25 p.s.i. on slicers requiring an average annual usage of 5,000 hours and a service life of five years.

DU bearings are ideal for many applications. They withstand much higher velocities, run much cooler at lower speeds than other unlubricated bearings . . . have a compressive strength of 51,000 p.s.i. DU bearings are applied without the need for temperature-limiting adhesives . . . will withstand from −450°F to +536°F.

GARLOCK

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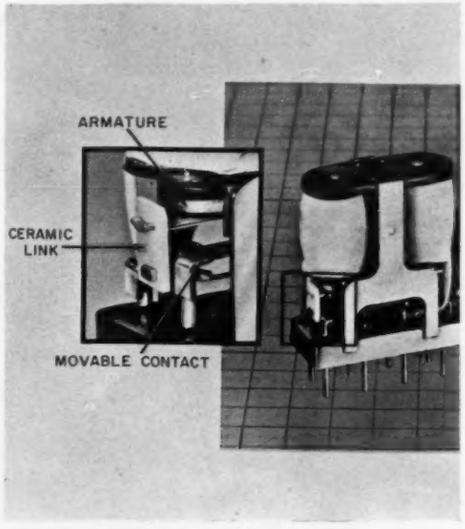
*Trademark, Glacier Metal Company, Ltd.

Circle 66 on Reader-Service Card for more information

Magnetic Latching Relays 326

Microminiature magnetic latching relays incorporate "matched action" armature and contact design to prevent sluggish action. The AM series is magnetically latched for operation from short power pulses. Both single and dual-coil units are available with a two-pole, double-throw contact arrangement. Relays are rated at 2 amps, at 28v d-c resistive, or 1 amp at 115v a-c resistive, with a minimum life of 10 million mechanical operations or 100,000 operations at rated load. High holding forces, augmented by a permanent magnet, provide high vibration and shock immunity. Tests show no contact opening under 30G vibration to 3000 cps or 100G shock. All relays are designed



and processed for either power or low-level switching. Operating temperature range is −65 to 125C. Relays are rated at 5 millisec maximum operate time, including bounce time, at twice maximum pickup current. Coil resistance is 0.050 ohm maximum before use; no more than double that after 100,000 operations. Bounce time is 1 millisec maximum. Units are furnished in standard grid-spaced configuration with terminations on 0.2- and 0.1-inch centers. Solder-lug or straight-pin terminals are standard, as are threaded-stud, flange or four-hole side-plate mounting forms. Weight is 0.65 oz maximum, not including mounting brackets or studs.

General Electric Co., Schenectady 5, N. Y.

Straits Tin Report

Tin-lined copper tube recently developed combines tin's corrosion resistance and malleability with the strength and ductility of copper. Pure molten tin is gas-propelled through the tubing to form a continuous, fusion-bonded tin lining that will not chip, crack or peel, and can be

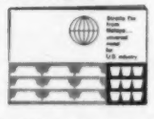
Photo courtesy Phelps Dodge

bent, flared, flattened or soldered. Tin provides immunity to corrosive sulfur conditions found in some natural gas and petroleum products; affords excellent resistance to flaking action that can plug lines and orifices and create hazards with gas appliances. The tin lining also prevents contamination of fluids in process lines of food, beverages, pharmaceutical and water distilling equipment and for sampling lines to laboratory or control instruments, according to its producers, Phelps Dodge Copper Products Corp.

Acid pickling of steel before hot tinning produces maximum bond strength of bearing metal to steel. Shot blasting preparation lowers bond strength, possibly because of distortion, folding and flowing during precleaning.

FREE Brochure

16 interesting pages of information about the latest uses of tin in U.S. industry. Write today for your copy.



The Malayan Tin Bureau
Dept. S-26-H, 2000 K St., N.W., Washington 6, D.C.

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Catalog 92 has 24 pages filled with useful information on neoprene coated fabric, wire reinforced Flexaust hose and Portovent retractable duct applicable to their use in air and materials handling, fume and dust control. Includes data on pressures, friction losses, construction, accessories, and other details essential to good design.

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Tempered Swedish Steel. Box-joint assures perfect jaw alignment. Scientifically case hardened and tempered in **all three** key areas: (1) Jaws, (2) Box Joint, (3) Handles. Also available with plastic cushion-grip. Wide range of styles.

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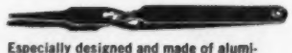

Especially designed and made of aluminum to quickly dissipate heat when soldering small wires, etc. Also ideal for use as a small parts tweezer and clamp. No. 349—3½" long .....20¢

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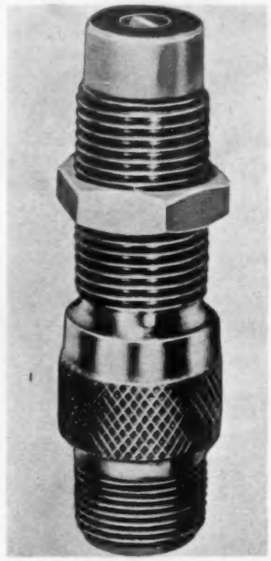
Magnetic Pickup 327

A voltage and frequency are generated when this electromechanical device is excited by slow-moving metal objects. As a self-generating input transducer, the Model 3045 provides the connecting link between mechanical motion and instrumentation without mechanical contact. When a gear tooth, pin or any other ferrous metal projection interrupts the external magnetic field, the pickup will generate voltage and current that can actuate electrical or electronic circuitry without



amplification and without the aid of additional power sources. The device may be used with gear teeth of 20 pitch or greater and will generate voltage/frequency in proportion to the speed of the metal teeth interrupting its magnetic field. This power is ample to operate many readout devices and to help solve a wide range of speed measurement and control problems easily and economically. Weight is 1.73 oz.

Electro Products Laboratories, Inc., 4500 N. Ravenswood Ave., Chicago 40, Ill.

GAGE PAGE

A Quick Run-down of New Gaging Ideas

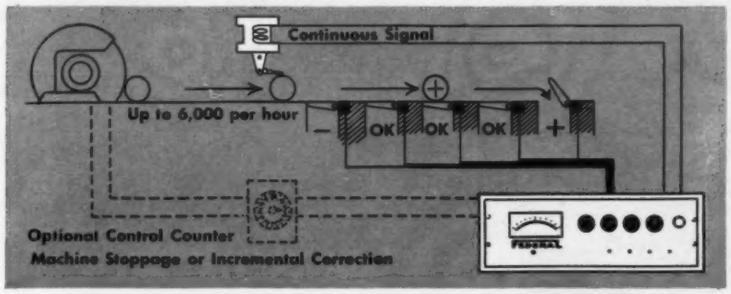
ELECTRONIC GAGING — *Economically*

Small Electro-Probe Gage Head for bench or automatic applications.

Highly versatile . . . Overtravel protected . . . Virtually frictionless response . . . Feather-light contact-pressure (less than 2½ grams) simplifies support design . . . Mounts in any position . . . Only 1½" x 2½" x 21/32" thick . . . Impervious to oil and water . . . Works with variety of Amplifiers and combined Amplifier-Classifiers.

— for example 230M-27 (pictured) provides 8 gaging ranges . . . min. grads. from .000010" to .002" . . . Center zero meter . . . Four control limits which can be preset from panel . . . Classifies into five size categories, e.g. "over", "under", and three classifications of "good". — This precision combination for about $850.

Gage Head with dual-range Amplifier is less than $500.



For complete specs, dimensions — the *whole* story — send for Catalog 60 AM.

FEDERAL PRODUCTS CORPORATION
1488 EDDY STREET, PROVIDENCE 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

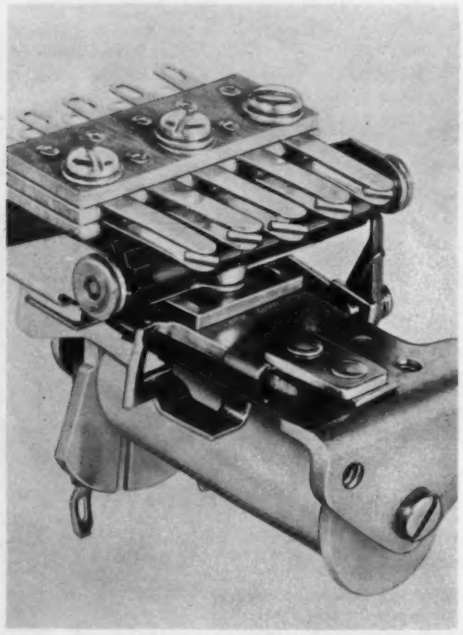
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Circle 70 on Reader-Service Card for more information

Design News • Design News • Design News •

Program Relay 328

A 5-pole, 12-position, 1450 Program Relay switch features fast, quiet operation, high reliability and long life in severe environmental conditions. The relay requires only 0.05 watt-sec for pulse operation or 2w for conventional actuation. Coil ratings are 6 to 220v, 60 cycles. Speed of operation is 10 millisec maximum for a 0.055 watt-sec pulse. Contacts of palladium, silver or gold are offered, with ratings up to 7.5 amps, 115v a-c. The unit is suitable for sequential control of computer, machine tool or TV remote or supervisory circuits. Its ruggedness, quiet operation, small size and weight (2 by 2 by 1-5/8 inches and 4-1/2 oz open), and its low power requirement make it suitable for military systems. The relay will operate more than five million times and is substantially immune to vibration and shock. Maximum operating temperature of the standard model is 85C, but the series can be made with special materials that permit operation at 600F.

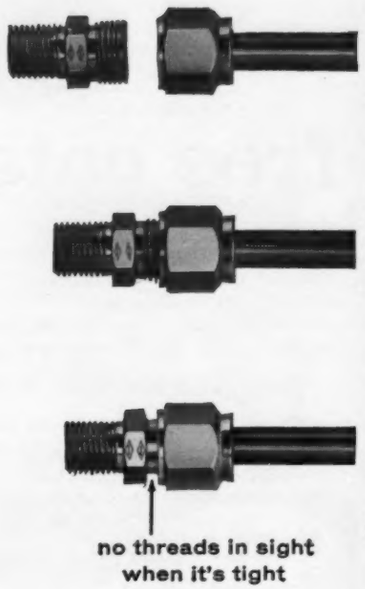


Cornell-Dubilier Electronics, Fuquay Springs, N.C.

you can

see
see
see

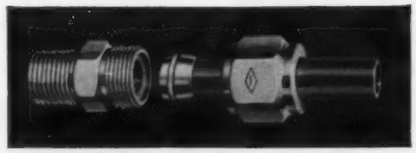
when it's tight



With Hi-Seal you can *see* that hazards are not installed in your tubing system. When the threads no longer show, the connection is pressure-tight. No other fitting offers this advantage.

This means an easy, foolproof assembly that is inspected with just a glance. Anyone who can handle a wrench can make a dependable Hi-Seal joint every time. No need for assembler to count wrench turns. No over- or under-tightening to worry about.

Hi-Seal flareless assemblies are made faster, more economically, more surely. Specify Hi-Seal tube fittings.



BUTT JOINT HI-SEAL

IMPERIAL EASTMAN

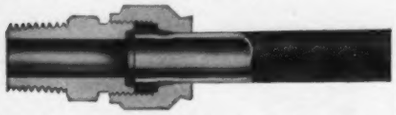
Imperial-Eastman Corporation General Offices: 6300 West Howard Street, Chicago 48, Illinois

Circle 71 on Reader-Service Card for more information

see

many reasons why you're ahead with HI-SEAL®

Seeing when they're tight is only one reason for preferring Hi-Seal fittings. Of course, this is a big one for fast, positive inspection and for design engineers who want leakproof, foolproof connections in any system.



Withstand vibration, high pressure — Hi-Seal fittings provide firm tube support for excellent vibration resistance. The fitting is a grip type, rather than a bite type. Three serrations in the sleeve establish the grip without damaging or weakening the tube.
When assembled, Hi-Seal fittings give you a pressure-tight seal compatible with the tubing required. For extreme pressure ranges, Braze-Seal fittings give make and break flexibility.

Make and break 25 times — Simple assembly and re-assembly of Hi-Seal butt-joint fittings mean greater re-use. Hi-Seal's standard is 25 re-uses. The industry standard is 15—or 66⅔% more for Hi-Seal.

Close bends — Butt-joint H-Seal fittings make close bends possible. Reduce space, material by as much as a half!

One fitting for entire system — Hi-Seal is the most versatile fitting you can use. By standardizing on Hi-Seal, installation and maintenance men can plumb a job fast, yet perfectly, in any pressure range. Available in all styles and combinations, plus a variety of metals—steel, stainless steel, brass, aluminum, titanium, Monel, etc.

Now Imperial-Eastman meets *all* your fluid piping requirements—tube fittings, valves, couplings, flexible and rigid hydraulic lines, thermoplastic tubing, and tubing tools.

FITTINGS

IMPERIAL – EASTMAN

ELECTRICAL

Hydraulic-Magnetic Relay 329

The Type "B", hydraulic-magnetic, time-delay relay is capable of switching up to 5-amp loads, either SPDT or DPDT. The main advantage of this new contact design is the protection afforded by phenolic contact housing, which not only prevents environmental contamination, but also eliminates any chance of unauthorized tampering. The heavy-duty coil does not need de-energization after each actuation, but can remain locked in indefinitely. This feature makes it possible for the relay to do double service—it can function both as a delay device and as a load relay. Available in 16 standard timings from 1/4 to 120 sec, the unit can be supplied for either a-c or d-c operation. Standard a-c voltages range from 6 to 240v; d-c, from 4 to 120v. Contact capacity is 5 amps at 125 or 250v a-c; 5 amps at 30v d-c, resistive; 3 amps at 30v d-c, inductive. Maximum power consumption is 2w a-c, 3w d-c. The relay measures 2.1 by 1.8 by 2.1 inches overall. Weight is 3.5 oz.

Heinemann Electric Co., 373 Magnetic Dr., Trenton 2, N.J.

WHAT MAKES *Alinabal* ROD ENDS BETTER?

One reason for the superior performance of Alinabal Rod Ends and Spherical Bearings is the precise control of the relationship of the spherical race to the ball.

Each Alinabal unit has a precision ground, through hardened steel race. Precise control of the race radius enhances low friction operation and prevents "end-loading" effects. This spherically ground race is manufactured for assembly around the ball, and is *not* a set of relatively soft, pressed inserts, nor is it a swaged housing. Moreover, loading slots are not used in the Alinabal construction method. Thus, the ball is positively and permanently retained under misaligning conditions.

Alinabal is the registered trade name for rod ends and spherical bearings manufactured under U.S. Patent 2,781,238.

A complete line — standard male and female rod ends — stud type rod ends — standard spherical bearings and rod linkages — sizes range from 3/16" to 4" bore. SEND FOR COMPLETE CATALOG

split ballbearing

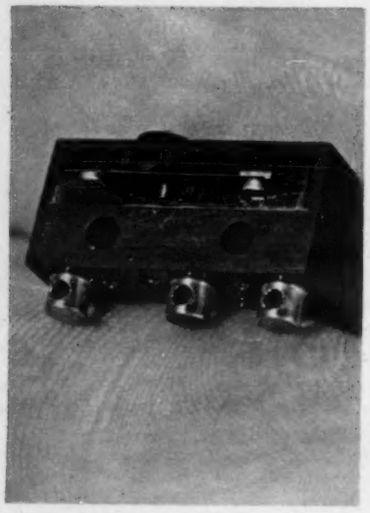
SBB DIVISION OF MPB INCORPORATED

LEBANON, NEW HAMPSHIRE

Circle 72 on Reader-Service Card for more information

Subminiature Switch 330

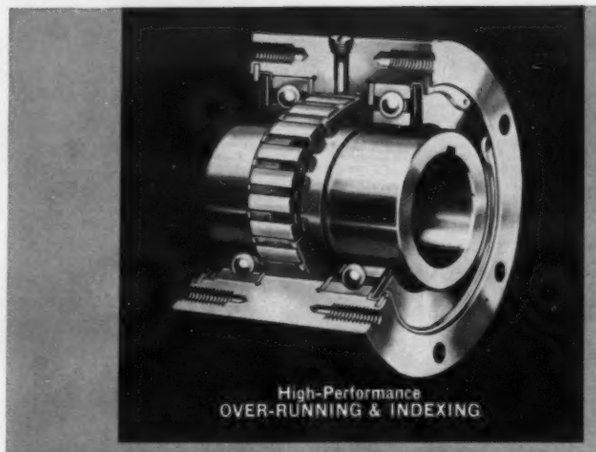
A precision, snap-action switch embodies a new design principle. "Cricket" action is used in the contact-carrying leaf spring. Uniform stress distribution achieved throughout the spring reduces metal fatigue. This results in long life with high reliability and continued uniform operation. The new line includes the basic SPDT unit complete with a series of lever-type actuators and toggle- or push-button-operated assemblies. The switch is rated at 5.0 amps at 125-250v a-c on inductive and resistive loads, 4.0 amps at 30v d-c on resistive loads, or 2.5 amps at 30v d-c on inductive loads to 50,000-

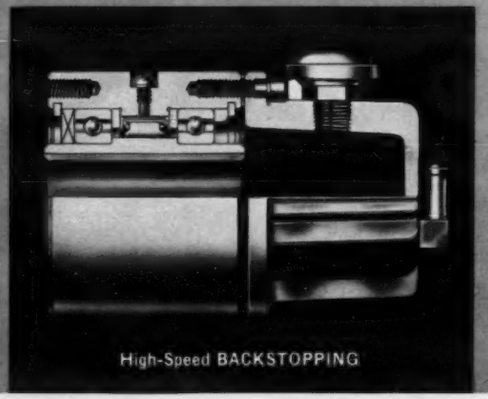


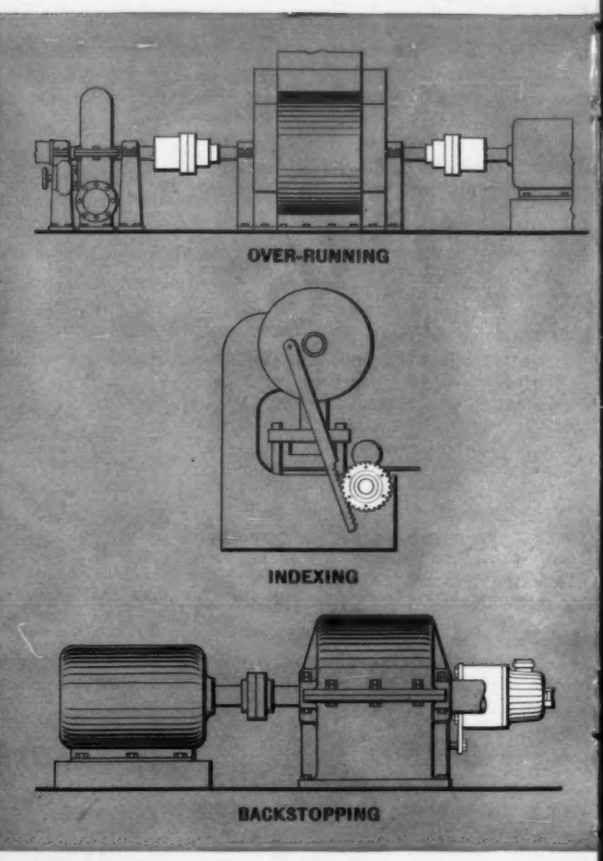
ft altitudes. Basic switch weighs less than 0.080 oz. The high-impact plastic case consists of a base with terminals molded in position and a cap that positions push-button actuator. Base and cap are plastic-welded into a single unit that maintains a ±0.002-inch maximum tolerance on all mounting dimensions.

Fansteel Metallurgical Corp., Contacts & Specialties Div., North Chicago, Ill.

FORMSPRAG Clutches have







These Installations Prove Formsprag Has The Most Advanced Clutch Designs Available

On tough applications requiring high-performance over-running, indexing or backstopping, Formsprag clutches have *proved* their unusual durability, precision and reliability. Their long-life and minimum maintenance requirements, even under unusually demanding installation conditions, have provided many users with the answer to their clutch problems. Compare the following performance results on actual installations—Formsprag designs can help you, too!

High-Performance Over-Running

Application:
Forced and Induced Draft Fans.

Clutch and Mounting:
Model FO-732 Clutch-coupling (HPO-720 clutch with coupling) mounted on fan drives.

Requirements:
Continuous over-running at 1200 to 1800 R.P.M. (24 hours a day, 365 days a year).

Proved Results:
The Formsprag HPO clutch design with Formchrome sprags provides this company with greater durability and less maintenance than any other available clutch. Therefore, on all forced and induced draft fans, this manufacturer specifies Formsprag high-performance over-running clutches.

Precision Indexing

Application:
High Speed Press.

Clutch and Mounting:
Model HPI-700 feeding a progressive die.

Requirements:
20° indexing; feed is 700 strokes per minute; accuracy of feed must be within .005"; press operates 24 hours a day, 5 days a week.

Proved Results:
After poor service life and unreliable results from other clutch designs, a Formsprag high-performance indexing clutch was installed. Result—customers requirements for accuracy were met, clutch has had a life of 80 million cycles and is still running.

proved higher performance

(GREATER TORQUE & SPEED, HIGHER PRECISION, LONGER LIFE)

During the last two years, Formsprag has announced several major advances in over-running clutch design. These advanced concepts have been widely accepted by designers of modern power transmission systems. The high performance results they obtained on over-running, indexing and backstopping applications *prove* Formsprag clutches to have the most advanced designs available.

On-the-job records *prove* these high performance characteristics: (1) Formchrome sprags, with high-hardness and wear resistance, provide exceptional durability—no other manufacturer can offer the performance advantages of Formchrome sprags. (2) The improved sprag and retainer design of Formsprag High-Performance Over-running (HPO) and Indexing (HPI) clutches permit up to 30% higher operating speeds with same life span and up to 70% longer clutch life when operated at same RPM as ordinary clutches. (3) On backstopping applications, the High-Speed Backstopping (HSB) clutch design permits higher speeds, assures longer life and reduces maintenance to a minimum.

Specific case-history data on *proved* over-running, indexing and backstopping installations is provided below. In every instance, users of Formsprag High-Performance Clutches have found the answers to problems of wear, high-speed operation, precision and maintenance.

There is a Formsprag Clutch for every application. Standard models include: sleeve bearing, ball bearing, miniature, large-bore holdbacks, and high-performance types. For special applications, Formsprag engineers will recommend a modified standard clutch or design a special. Standard clutches are fully described in the Formsprag catalog—send for your free copy.

FORMSPRAG COMPANY

23605 Hoover Road, Dept. 114-A — Warren (Detroit), Michigan

Representation Throughout The World • Precision Power Transmission Products

High-Speed Backstopping

Application:
Iron Mining (Taconite) Conveyor.

Clutch and Mounting:
Model HSB-700 clutch assembly mounted on high-speed shaft of reducer.

Requirements:
In abrasive atmosphere, clutch must over-run at 1200 to 1800 R.P.M. (24 hours a day, 9 months of year).

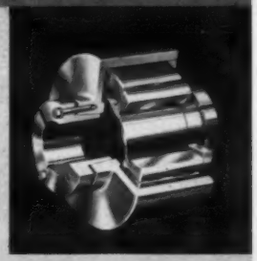
Proved Results:
On this rugged backstopping application, Formsprag HSB clutches solved problems of overheating, premature seal wear, and short clutch life. These high-speed backstopping clutches have been in operation for over a year and are still delivering their initial high performance.

OTHER FORMSPRAG PRECISION PRODUCTS

NEW RAWSON

CENTRIFUGAL CLUTCHES and CLUTCH-COUPLINGS

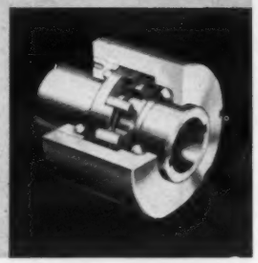
Used in a wide variety of applications, the Rawson design provides no-load starts for motors and cushioned starting of driven equipment. They permit using smaller motors and across-the-line starting.



REVLOK

DUAL TORQUE-LOCKING and POSITIONING DEVICES

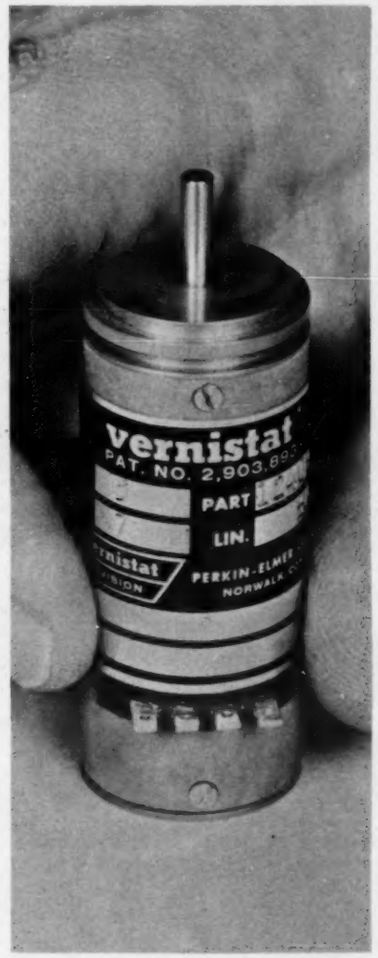
These multi-purpose devices stop feedback torque and provide two-directional positioning, over-running, backstopping and load-limiting. They can also be adapted for single revolution and torque-limiting functions.



Circle 73 on Reader-Service Card for more information

10-Turn A-C Potentiometer 331

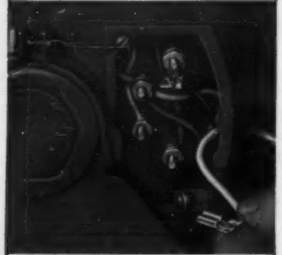
This high-precision, military-type potentiometer is designed for use with servos, computers, and guidance and fire-control systems. It has high input-to-output impedance ratio, high terminal linearity, low phase shift and high inherent reliability. The Size 9 low-cost pot achieves precise voltage ratios and low output impedance by means of a tapped autotransformer. Specifications include a 30,000-ohm input impedance, a 160-ohm output impedance and a 0.2-μv/v quadrature at 400 cps. Terminal linearity is $\pm$0.05 percent.



Perkin-Elmer Corp., Vernistat Div., Norwalk, Conn.

Quick Break Switch

The starting winding is disconnected from the line by this Wagner designed switch . . . test proved to make more than a million breaks. (That adds up to two starts per hour for 50 years!)



Quick Connect Terminals

Brass tabs on terminal studs permit quick, easy connection of leads . . . cut wiring time to speed assembly line production. Simply press the lead receptacle on to the stud—a positive connection is assured.

NO STARTING PROBLEMS

with

WAGNER CAPACITOR-START MOTORS

Pack more power into less space . . . give long troublefree service . . . are easy to hook up

Here are general purpose single-phase motors that have high starting torque and high pull-in torque. When used in the proper application and supplied with voltage close to their rating, they'll give positive starts every time. Troublefree operation is assured . . . thanks to the positive action of the Wagner governor mechanism and long life quick-break switch.

Wagner Type RK Motors pack more power into less space. Small enough to fit in tight spots, their ruggedness is built-in . . . permits direct mounting. They are available in a range from ¼ through 5 horsepower, with sleeve or ball bearings, and with rigid bases or resilient mountings. And, sleeve bearing fhp models can be operated in any position.

Get these motors from leading distributors in your city, or from Wagner Sales Offices in 32 cities across the country. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-217 gives full details on Capacitor-Start Motors.

Wagner Electric Corporation

6487 Plymouth Avenue, St. Louis 33, Missouri

WH60-1A

All-Angle Operation

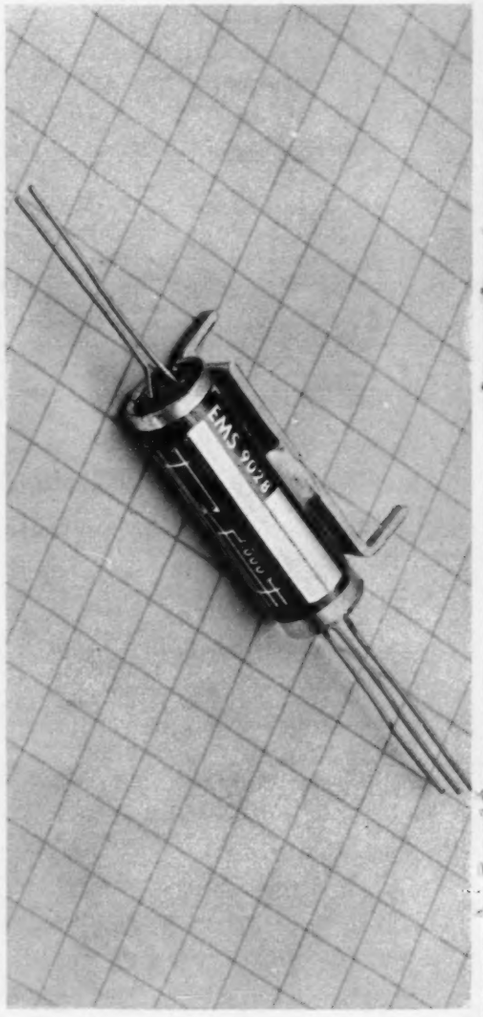
The sleeve bearing design, in fractional hp ratings, has a positive lubrication system that permits operation in any position . . . can mean important savings in motor costs to manufacturers.

Circle 74 on Reader-Service Card for more information

Subminiature 2-Amp Relay 332

An SPDT, hermetically sealed, subminiature relay weighs under 0.17 oz. The electromechanical device is housed in a compact, 0.275-inch-dia tube and is under 0.900 inch long. Contact low-level rating is 8 microamps at 16 millivolts. Specifications include shock of 30G and vibration of 20G from 5 to 1000 cps and 10G from 1000 to 2000 cps. Insulation resistance is 10,000 megohms minimum between leads. Construction of the high-speed "Micro-Mite" permits a wide choice of coil voltage (both a-c and d-c). In addition, a selection of several mounting options is available.

Electro-Mechanical Specialties Co., Inc., Whittier, Calif.



Setko's 23 Years of Progressive Engineering Experience Keeps Screws Modern as Tomorrow's Products

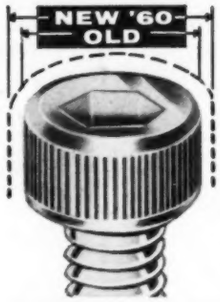
SETKO NEWS

Bartlett, Illinois (Chicago Suburb) Progress Edition

We Specialize in Solving Puzzling Screw Problems

NEW '60* SERIES CAP SCREWS HAVE EXTRA HOLDING POWER

4 BIG EXTRA MONEY-SAVING ADVANTAGES WITH SETKO



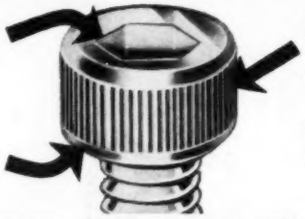
Compare the new head sizes of the new '60 series with the old '36 series and you'll *see* the many *extra* money saving advantages you get. For example: *Broader bearing area under the head*—often eliminates the need for washers. *Bigger head sockets for greater tightening torque*—give more holding power.

You get this extra size only where it counts—in the extra width of the head. (Head height remains unchanged.) In addition, you get *longer service life* and *more re-use value* when you specify Setko '60 series, Cold-Forged, Socket Head, Cap Screws.

LARGER HEAD SIZE PAYS OFF IN SAVINGS

BIGGER HEAD SOCKETS on many sizes take greater tightening torque without breakage or damage.

BROADER BEARING AREA under the head, distributes the load over a larger bearing area. Stops needless indenting of softer metals.



BETTER STRENGTH CHARACTERISTICS assure longer life—can be reapplied more times.

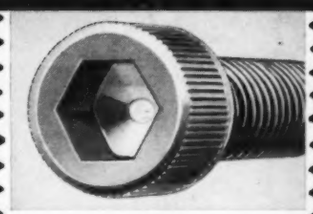
STAINLESS STEEL Cold-forged Cap Screws now available in many sizes.

DATA CHART SHOWS INCREASED SIZES

*'36 series will continue to be available.

Screw Size	Min. Head Dia. Inches		Bearing Area Min. Sq. In.		% Increase Bearing Area	Hex Key Size (Width Across Flats)	
	1936	1960	1936	1960	1960 over 1936	1936	1960
# 2	.136	.134	.006	.006	–	1/16	5/64
# 3	.157	.154	.008	.008	–	5/64	5/64
# 4	.178	.176	.011	.011	–	5/64	3/32
# 5	.200	.198	.015	.015	–	3/32	3/32
# 6	.221	.218	.019	.019	–	3/32	7/64
# 8	.265	.262	.026	.026	–	1/8	9/64
#10	.306	.303	.036	.036	–	5/32	5/32
1/4	.367	.365	.044	.044	–	3/16	3/16
5/16	.429	.457	.052	.070	33	7/32	1/4
3/8	.553	.550	.111	.111	–	5/16	5/16
7/16	.615	.642	.147	.200	36	5/16	3/8
1/2	.739	.735	.183	.183	–	3/8	3/8
5/8	.863	.921	.216	.293	35	1/2	1/2
3/4	.987	1.107	.224	.424	89	9/16	5/8
7/8	1.111	1.293	.253	.585	131	9/16	3/4
1	1.297	1.479	.405	.768	89	5/8	3/4

For dimensions on 36 series see latest Setko Catalog.



A Setko exclusive

"PERFECT-HOLE" SOCKETS assure perfect key engagement!

You can exert maximum torque for *total* holding power because the hex socket is perfect. Permits perfect engagement of hex key against all of the bearing walls of the socket. Pressures exerted on the socket, are perfectly equalized for maximum driving power. Cap Screw life is extended and more re-applications are possible. Specially designed machinery and die tools, built to Setko specifications, are the reason for these cost-cutting, life-lengthening, money-saving, *plus* features.

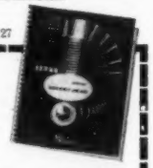
Ask for free test samples

NEW FOLDER GIVES ALL THE FACTS

Contains complete specifications, dimensions and information about the new Setko '60 series of Cold-Forged, Socket-Head, Cap Screws. Fill in the coupon below, tear out and mail today. Ask for free test samples. Send us your requirements for advantageous quotations.

727

SETKO



Set Screw & Mfg. Co.
147 Main Street
Bartlett, Illinois

- ☐ Send me new free folder on Setko '60 Series Socket Head Cap Screws.
- ☐ Send me test samples of size .....'60 Series Cap Screws.
- ☐ Requirements attached, please send me your advantageous quotations.

Please write your name, company and address on the margin of this page.

Circle 75 on Reader-Service Card for more information

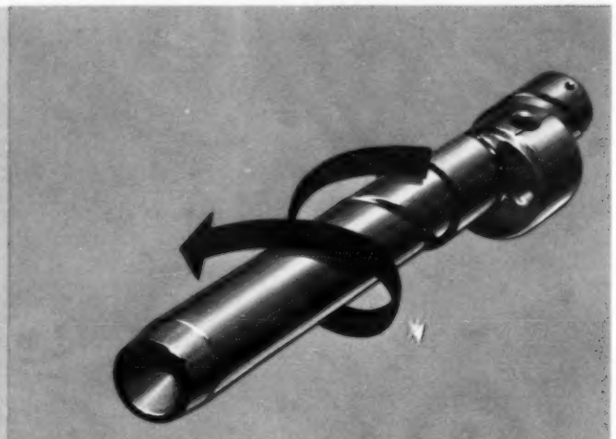
Post-Forming: New Way to Bigger Savings with Malleable Castings

The ductility of Malleable iron castings permits use of high-speed forming techniques to finish Malleable parts at lower cost. Take advantage of the versatility you get only with ferritic and pearlitic Malleable castings. For a fuller understanding of how Malleable can help you, call any producer that displays this symbol —

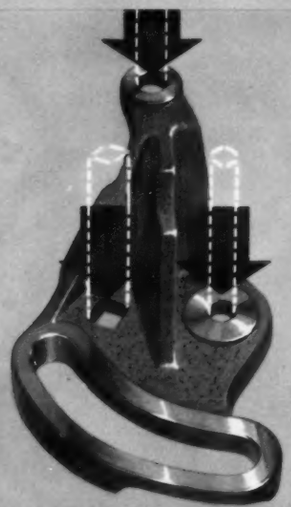
Free Folder describing these techniques is available for your use. Just ask any member of the Malleable Castings Council for Data Unit No. 116, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

MEMBER
MALLEABLE
CASTINGS COUNCIL

Hot Form It — Hot coining this Malleable transmission part reduces finished cost . . . eliminates three cutting operations required by the previously used steel part.



Roll It — Oil grooves in lawnmower crankshafts and splines in compressor crankshafts are just two of many places where rolling proves more economical than machining.



Punch It — Holes with diameters greater than the thickness of the metal can be punched in Malleable. Two round holes and a square hole are punched simultaneously in this idler arm.

Spin It — Malleable's ductility permits the sleeve and end disc in this ball joint to be held in place by spinning the Malleable housing into a strong, permanent flange.

Get the most for your metals dollar...get MALLEABLE

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Iron Works, Moline
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Albion Malleable Iron Company, Muncie Division, Muncie
Link-Belt Company, Indianapolis 6
National Mall. & Steel Castings Co., Indianapolis 22

IOWA
Iowa Malleable Iron Co., Fairfield

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

MISSISSIPPI
Mississippi Malleable Iron Co., Meridian

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division, Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
National Mall. and Steel Castings Co., Cleveland 6

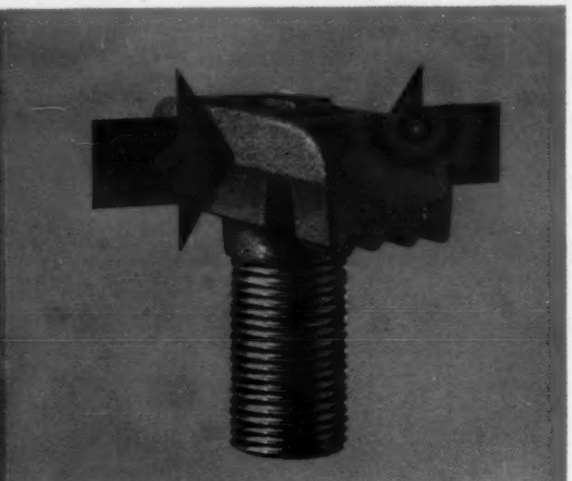
PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

TEXAS
Texas Foundries, Inc., Lufkin

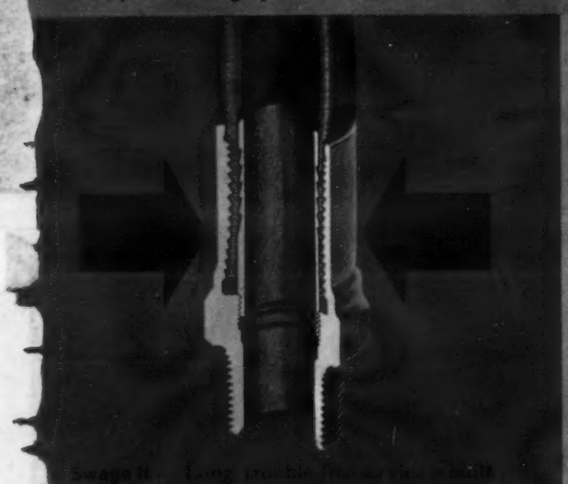
WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, Inc., West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

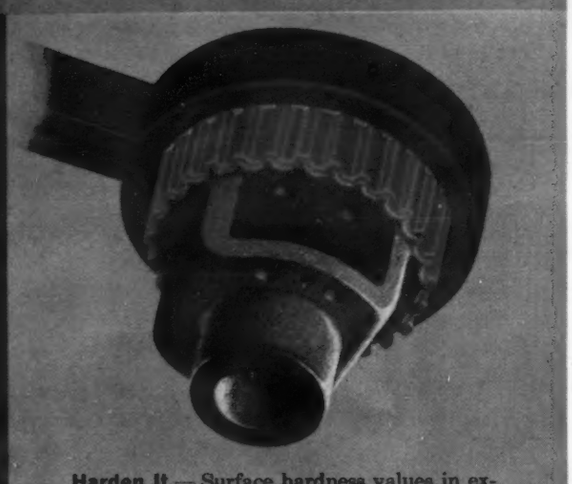
Bend It — A 30% cost reduction was achieved by casting this Malleable iron twine finger flat . . . then bending the arm about 45 degrees and coining the center hub in one fast, post-forming operation.



Coin It — Very close tolerances are often met economically by either cold or hot coining. The head of this T-bolt is coined to meet tolerances of ± .005" on its .475" width without any machining.



Swage It — Long trouble-free service built into this high-pressure hose coupling by swaging the Malleable fitting around the reinforced hose in a 15-ton press. It's a fast, permanent and economical gripping [illegible]



Harden It — Surface hardness values in excess of 55 Rockwell C can be achieved with pearlitic Malleable by either flame or induction hardening. Response is excellent, and results are uniform.

Circle 76 on Reader-Service Card for more information

Logic Switch Light 333

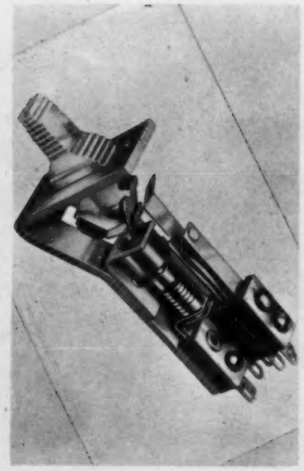
A miniature logic switch light combines the versatility and space-saving characteristics of both the logic light and the switch light configurations. Designed for high-reliability systems where signal and space are limited, this unit includes a momentary-contact SPST switch; a transistor/resistor circuit for operating indicator at extremely low signal levels, and a replaceable plug-in lamp and resistor unit which activates the switch. The lamp supplied can be either neon or incandescent. All functions are incorporated in an anodized case measuring 2.30 inches maximum length with only 1.38 inches behind panel. A variety of lens shapes and colors is available and the unit is supplied with turret or taper socket pin terminals. Variations in the circuit elements can be made to fulfill customer requirements.

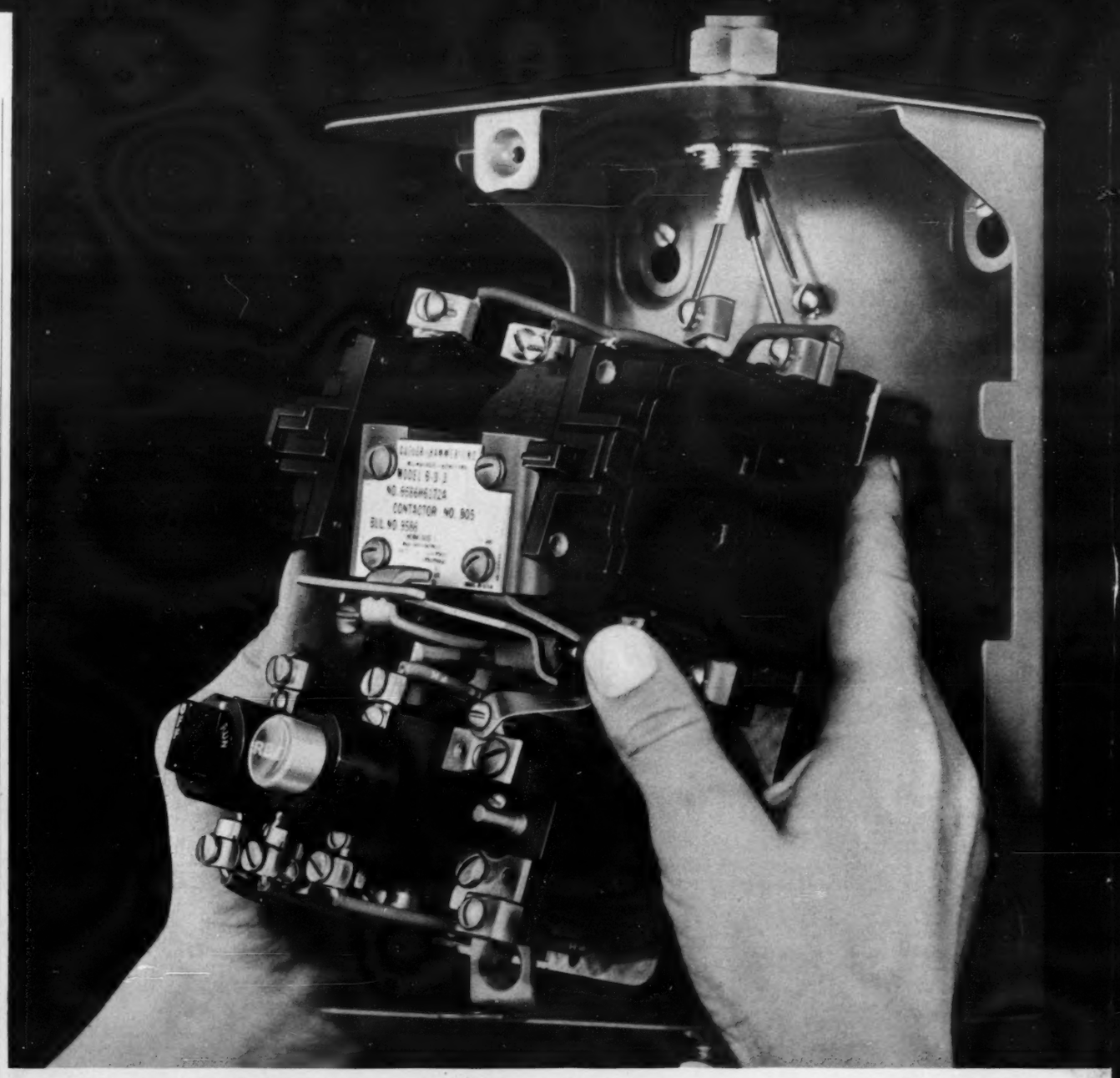
Eldema Corp., 1805 Belcroft Ave., El Monte, Calif.

Illuminated Lever Switch 334

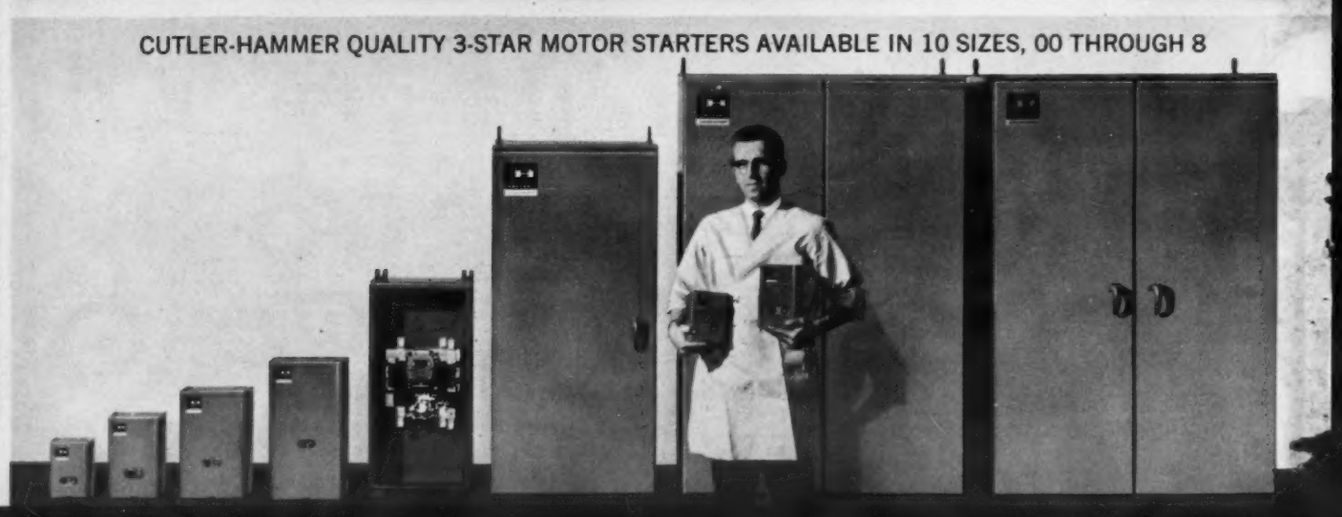
The "Lever-Lite" is designed to color-code switching positions and functions. One switch replaces an ordinary unit and up to three indicator lamps. Control panel costs and space requirements can be cut by at least 40 percent. A heavy-duty frame has been designed to provide long electrical and mechanical life. Long-frame, leaf-type switching is incorporated for high dependability. The color-disc arrangement in the light section utilizes one lamp. Colors available are red, green, amber and white. Operating voltage is 6 or 28v. The unit is available in Series 25,000, two- and three-position, nonlocking types; and in Series 25,000L, two- and three-position, locking types.

Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.





CUTLER-HAMMER QUALITY 3-STAR MOTOR STARTERS AVAILABLE IN 10 SIZES, 00 THROUGH 8



CONTROL

CUTLER-HAMMER MOTOR STARTERS

Still the proven standard of quality...always in stock for immediate delivery

Millions of satisfactory operations in thousands of applications have proved the unmatched quality of Cutler-Hammer across-the-line magnetic starters. That this line is still recognized as the leader—nine years after the original design was developed—is a great tribute to the years-ahead thinking of Cutler-Hammer engineers.

FIRST IN '53—STILL THE LEADER IN '61

Since the Three Star line was introduced in 1953, many improvements have been made; magnet coils that far exceed NEMA standards, for example. But many achievements of the original design—vertical, dust-free contacts; overload relays adjustable to within 3% of actual full-motor ratings; provision for 2 or 3-coil overload relays in the same enclosure—are features no other manufacturer has been able to improve. You can safely bet that when these pace-setting features are improved, it'll be another Cutler-Hammer development.

ALWAYS AVAILABLE FOR FAST DELIVERY

You'll find the smaller sizes of Cutler-Hammer Starters always in stock at your local distributors—larger sizes immediately available from the factory. We hope you'll make your own feature-by-feature comparison between the Cutler-Hammer line and any other starter on the market. Look especially carefully at such vital advantages as ease of installation, high interrupting capacity, coil construction and accessibility.

Regardless of what features you select as the criterion of superiority, we're sure you'll choose Cutler-Hammer after you've made your unbiased comparison.

If you're one of many companies being forced to stock two sets of parts because of design changes, now is an excellent time to standardize on Cutler-Hammer.

Call your distributor or local Cutler-Hammer Sales Office soon. Or write for Publication LO-70-Q272.

WHAT'S NEW? ASK..

CUTLER-HAMMER

CONTROL

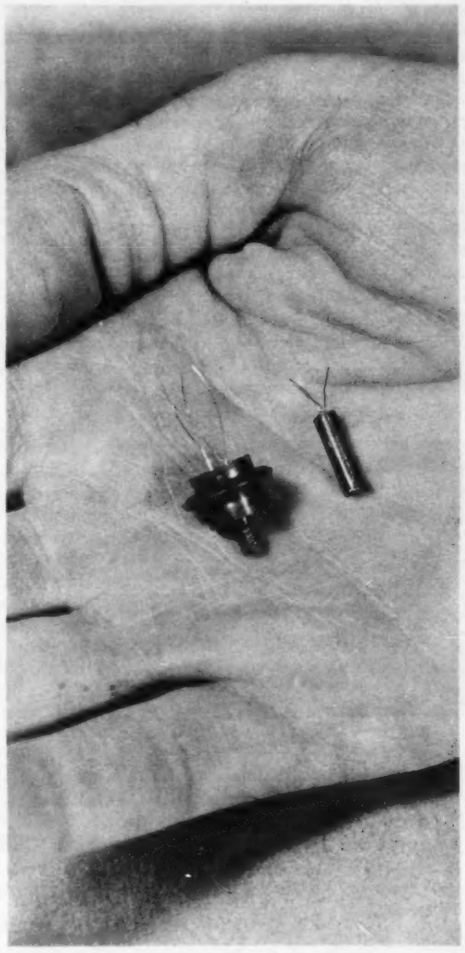
Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.

Circle 77 on Reader-Service Card for more information

Cryogenic Sensors 335

Two cryogenic sensors, each about the size of a nickel, offer a temperature-measuring range of 4 to 40K (−269 to−233C). The tiny sensors are germanium semiconductors designed for application in test and operational phases of space vehicles using liquid helium and nitrogen and for use in calibration and standards laboratories. One type of sensor measures surface temperatures; the other is a probe-type unit for internal applications. Both are encapsulated and hermetically sealed. Thermometer elements are precision doped with special impurities to provide high thermometric sensitivity. Each is equipped with a separate current and potential contact, a feature said to assure long-term stability that is unaffected by fluctuations in contact performance.

Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa.



ADVANTAGES OF FLEXIBLE SHAFTING

For Power Drive & Remote Control

by C. Hotchkiss, Jr.
Application Engineer,
Stow Manufacturing Co.

Flexible shafting has the following advantages over other type drives:

1—It is often the simplest method of transmitting power between two points which are not collinear or which have relative motion
2—eliminates exposed revolving parts
3—does not require accurate alignment
4—easy to install and maintain

Not Collinear — Where it is necessary to connect two shafts which are not collinear, a simple arrangement of a single belt or two universal joints will often do the job accurately. But, in many cases where the path of transmission is more complicated and would require a more expensive arrangement of mechanical components, flexible shafting provides a simple, low cost, efficient drive which is easy to install because it does not require accurate alignment. See example, figure 1, in which a 1¼ inch Stow flexible shaft is used to drive the auger on a G.L.F. bulk feed truck.

Flexible shafting also allows the designer greater freedom in locating either the drive or the driven component on a piece of equipment.

Fig. 1

Relative Motion—Where two shafts which have relative motion must be connected, flexible shafting is often the ideal means of transmission. In many cases it eliminates a much more complicated drive which would, necessarily, include telescopic joints; further, it eliminates the danger of exposed moving parts. See figure 2, which shows a ¾ inch Stow flexible shaft driving an Avery Rake built by the Minneapolis Moline Company.

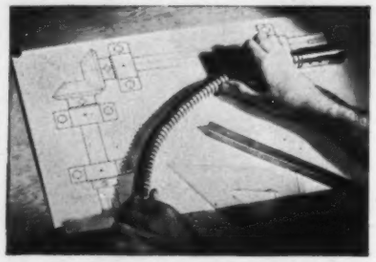


Fig. 2

Other typical applications of this type are used on portable power tools when motors are too heavy to be mounted on the tool—such as portable grinders, sanders, paint scrapers, saws and tree tappers. And, since flexible shafting is not affected by vibration, it is an ideal drive for applications where a high degree of vibration is involved—such as in vibration testing tables and concrete vibrators.

Stow flexible shafts are available for power drive applications in diameter sizes from ⅛ inch to 1¼ inches; for remote control applications in diameter sizes from ⅛ inch to 1⅝ inches. The 1¼ inch power drive shaft will transmit up to 10 HP while the 1⅝ inch remote control shaft will transmit up to 4000 lb. in.

For complete engineering data on flexible shafting, including selection charts, write for engineering Bulletin 570.

STOW MANUFACTURING COMPANY
308 SHEAR STREET, BINGHAMTON, NEW YORK
Circle 78 on Reader-Service Card for more information

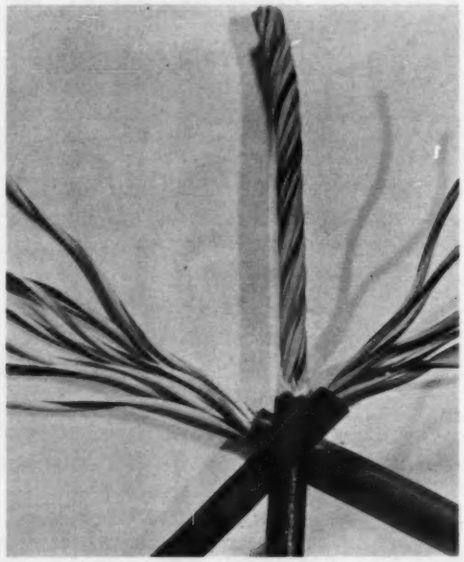
MATERIALS

Epoxy Molding Compound 336

A single-component epoxy molding compound cures in as little as 15 sec. This compound overcomes many of the deficiencies formerly considered inherent in one-component epoxy-resin/catalyst combinations. A dry granular material, the EMC 90 series is nonburning and offers a storage life of one year or longer at room temperatures. Developed for component encapsulation and structural uses, this series permits high flow at low temperatures and pressures while providing good mold release and rigidity of parts upon ejection from mold. Manufactured in blue or black, mineral filled, the compounds offer a variety in balance of physical, electrical and chemical properties in four-current formulations.

American-Marietta Co., Adhesive, Resin & Chemical Div., 3400 13th Ave. S.W., Seattle 4, Wash.

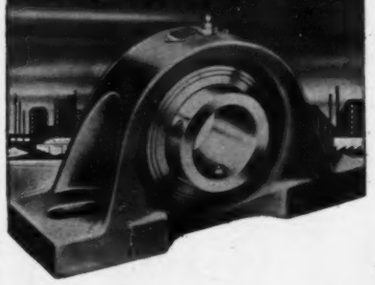
Color-Striped Silicone-Rubber Wire 337



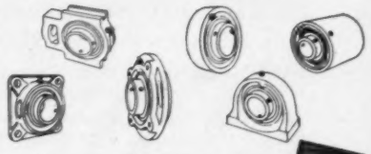
Color-striped silicone insulation permits the use of smaller wires in multiconductor cables and results in lighter-weight, extra-flexible, reduced-diameter cable. The smaller wires also eliminate braids which are subject to fraying and moisture absorption. The new process of striping permits the production of silicone-rubber insulation with multicolor markings that will not rub off and allows a variety of color combinations. Wire is available in AWG sizes 24 through 10.

Boston Insulated Wire & Cable Co., 65 Bay St., Boston 25, Mass.

SEALMASTER BEARING UNITS
turning point for production!



SEALMASTER Ball Bearing Units are the answer to industry's quest for high speed and precision in production. In daily operation throughout the industrial field, SEALMASTER Bearing Units keep production on the move, reduce maintenance and "down-time" and give their users carefree bearing service.



See your Sealmaster Distributor or write for Bulletin 454

SEALMASTER

SEALMASTER BEARINGS
A DIVISION OF
STEPHENS-ADAMSON MFG. CO.
29 Ridgeway • Aurora, Ill.
PLANTS IN: LOS ANGELES, CALIF. • CLARKSDALE, MISS. • BELLEVILLE, ONT. • MEXICO CITY, D. F

Circle 79 on Reader-Service Card

fine tubing in columbium and tantalum

You can now get fine, seamless tubing in columbium and tantalum from UNIFORM TUBES and profit from UNIFORM's standard policies of (1) top quality, (2) close tolerances, (3) fast delivery and (4) low prices. Drawn to your specifications with tolerances of ± 0.0005″ or better, columbium and tantalum tubing is available with any specified O.D. from 0.010″ to 0.500″. Wall thicknesses range from 0.065″ to 0.001″ with equally close tolerances.

Although drawn specially to your order, columbium and tantalum tubing will normally be shipped within 2 to 3 weeks.

This tubing is offered in random straight lengths to 20′ or cut to specific lengths, free of burrs. For subsequent ease of fabrication, tube lengths are fully annealed in vacuum furnaces. If you prefer, UNIFORM will fabricate columbium and tantalum tubular parts for you with the same skills and care that enable us to draw the original tubing to such close tolerances. Besides placing full responsibility with one supplier, you get the advantages of UNIFORM's low prices when tubular parts are fabricated "at the mill."

If you use or specify columbium or tantalum for their high-temperature strengths, corrosion resistances to hot acids, molten metals and metallic salts, or for their other outstanding properties, then write today for details on fine seamless tubing and fabricated parts of these rare metals.

UNIFORM TUBES, INC. COLLEGEVILLE 2, PA.
HUxley 9-7276 TWX CGVL 1044

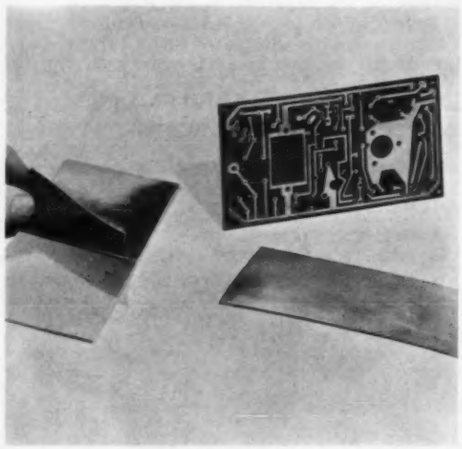
Circle 80 on Reader-Service Card

Corrosion-Resistant Lubricant 338

This one-coat, air-dry lubricant can be applied by spraying, dipping or spray-tumble. The coating combines corrosion resistance and lubrication in one step, eliminating need of other corrosion-resistant coatings. Parts coated with "Electrolube" have withstood 100-hr salt-spray tests with no visible traces of corrosion. The coating is only 0.0002 to 0.0005 inch thick with a coefficient of friction as low as 0.025 under high loads.

Electrofilm, Inc., 7116 Laurel Canyon Blvd., North Hollywood, Calif.

Printed-Circuit Adhesives 339

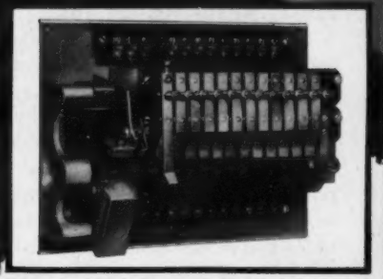


Four liquid synthetic resin-based thermosetting adhesives offer bonding of copper foil to phenolic or epoxy-impregnated base stock, phenolic paper, epoxy paper and epoxy-glass materials. Adhesive EC-1857 is designed for bonding untreated copper foil to epoxy or phenolic-impregnated base stock. The bond between copper foil and base material can be immersed in a 450F solder bath for 35 sec or a 470F solder bath for 20 sec without losing adhesion or blistering. Cured bonds have a peelback strength of 6 lb per inch width on 1-oz foil. EC-1855 is specifically for bonding treatment "A" copper foil to phenolic or epoxy-impregnated base stock. Peelback strength of cured bonds averages about 10 lb per inch width on 2-oz foil. EC-2080 is designed for bonding treatment "A" copper foil to phenolic paper, epoxy paper and epoxy-glass-based material. This adhesive bonds between foil and base stock and can be immersed in 500F solder bath for 10 sec without losing adhesion or blistering. Peelback strength of bonds is 10 lb per inch width on 1-oz foil. EC-2130 is essentially the same as EC-2080, except that this material resists chromic acid solutions.

Minnesota Mining & Mfg. Co., Adhesives, Coatings and Sealers Div., 900 Bush Ave., St. Paul 6, Minn.

A BASIC CONTROL IDEA

as simple as 1+2=3



DESIGN YOUR NEXT MACHINE OR PROCESS CONTROL CIRCUIT THIS EASY WAY

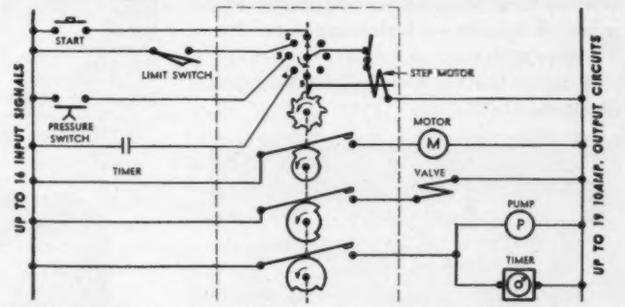
Start with THE BULLETIN 780 STEP SWITCH FOR STEP-BY-STEP SEQUENCE CONTROL

1 INPUT SIGNALS + 2 BULLETIN 780 STEP SWITCH = 3 PROGRAMMED SEQUENCE CONTROL

Closure of a control device, actuated upon completion of an operation, advances control to next position.

Circuits are opened or closed at each position or step according to preselected cam action.

Loads are interlocked thru step switch cams without complicated relay circuitry.



Write for Bulletin 780 or call your local Representative. He's listed in Sweet's Product Design File, Section 7d/EA, or in Thomas Register.

Precision Interval Timers | Plug-in Reset Timers | Multiple Circuit Timers | Multiple Cam Timers | Predetermined Counters | Hermetically Sealed Timers

MANUFACTURERS OF THE MOST COMPLETE LINE OF INDUSTRIAL TIME-COUNT CONTROLS AVAILABLE

BLISS

EAGLE SIGNAL COMPANY • Moline, Illinois
INDUSTRIAL DIVISION

DIVISION OF THE GAMEWELL COMPANY, AN E. W. BLISS COMPANY SUBSIDIARY

Circle 81 on Reader-Service Card for more information

'Teflon'-Insulated Wire 340

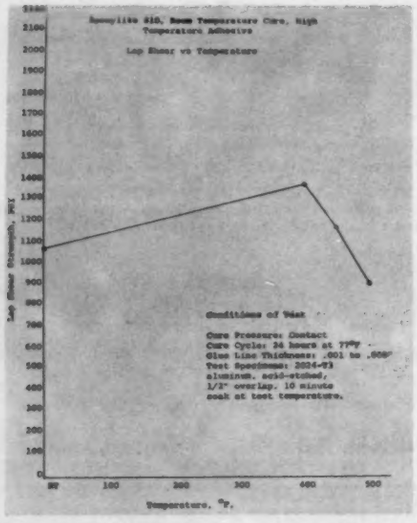
Extruded "Teflon"-insulated hookup wire offers continuous operation at 260C. The wire meets all requirements of MIL-W-27300 (USAF). Nickel-plated copper conductors, manufactured to close dimensional and resistance tolerances, are used. Sizes from AWG 26 to 12 are available.

Tensolite Insulated Wire Co., Inc., Tarrytown, N.Y.

Epoxy-Resin Adhesives 341

A room-temperature-curing adhesive for service at 400F is a two-component material consisting of an epoxy paste and a powdered curing agent. "Epoxylite 810" provides good adhesive strength at temperatures up to 400F and also maintains good adhesive properties for service lives in excess of 200 hr at 400F. It will withstand short exposures to 500F. The epoxy has a pot life of 15 minutes at room temperature; it cures in thin glue lines in 24 hr, though several days to a week are required for maximum development of adhesive strength. Heat lamps may be used to speed cure, but in general this adhesive obviates the need for large, expensive bake ovens in many production situations. Preliminary field uses have involved bonding of reinforcing hat-cap sections to high-speed aircraft panels, patching ablation shielding on missiles and bonding lead balancing weights on high-temperature electric armatures.

Epoxylite Corp., 1428 N. Tyler St., South El Monte, Calif.


Epoxylite 810, Room Temperature Cure, High Temperature Adhesive
Lap Shear vs Temperature
Lap Shear Strength, PSI
Temperature, °F.
Conditions of Test
Cure Pressure: Contact
Cure Cycle: 24 hours at 77°F
Glue Line Thickness: .001 to .005"
Test Specimens: 2024-T3 aluminum, acid-etched, 1/2" overlap. 10 minute soak at test temperature.

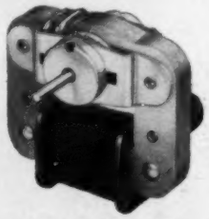
THE MARK OF QUALITY
BARBER COLMAN

select the motor needed for your application

Did you know that Barber-Colman Company makes both a-c and d-c motors? On these pages we have tried to tell very briefly a little about each of our motors. Featuring high quality at low cost, Barber-Colman 115 volt a-c (6-220 volt optional) shaded pole motors are excellent for commercial and industrial applications. Barber-Colman d-c precision motors are available in a variety of voltage ranges, styles and specifications to meet airborne and industrial applications. Look at the motors illustrated and then ask us for more literature on the one that interests you most.

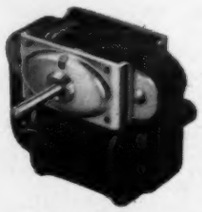
BARBER-COLMAN COMPANY
ROCKFORD, ILLINOIS

A-C SHADED POLE UNIDIRECTIONAL MOTORS FOR COMMERCIAL APPLICATIONS



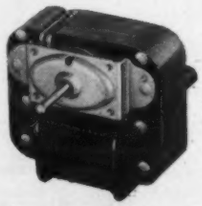
AYAA — DYAA — KYAA

Specifications:
Rated horsepower .0007 to .0010
Length ..... 1-1/8" plus shaft
Dimensions .... 2-7/32" x 2-1/4"
Remarks ....Exceptionally small and compact.
Typical applications — fan blades, blowers, reroll chart drives, phonographs, and gear trains.



DYAB — KYAB

Specifications:
Rated horsepower .0017 to .0066
Length ... 1-5/8" to 2" plus shaft
Dimensions... 2-3/8" x 2-19/32"
Remarks ....High starting torque
Typical applications — slide projector fans, hair dryers and refrigerators, vending machines, office machines, and rotisseries.



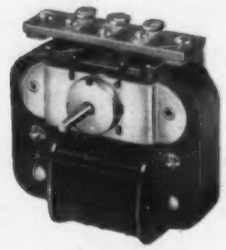
DYAF — KYAF — OYAF — CYAF

Specifications:
Rated horsepower .0045 to .032
Length ..... 1-5/8" to 2-9/16" plus shaft
Dimensions... 2-21/32" x 2-3/4"
Remarks ....High running torque
Typical applications — fans for heaters, deodorizers and electronic equipment; blowers and gear trains.

AYAR — BYAR — CYAR — DYAR

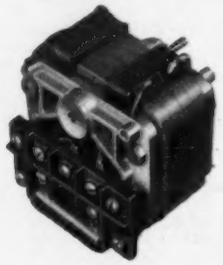
Specifications:
Rated horsepower .005 to .050
Length ..... 1-29/32" to 3-11/32" plus shaft
Dimensions..... 3-1/8" x 3-1/4"
Remarks .....High start or high power rotors available
Typical applications — pumps, humidifiers, vaporizers, combustion and industrial controls.

A-C SHADED POLE REVERSIBLE MOTORS



AYAE-DYAE-KYAE

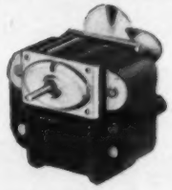
Specifications:
Rated horsepower .00015 to .006
Length ..... 1-13/64" to 1-53/64" plus shaft
Dimensions ..... 3" x 2-7/8"
Remarks .Adaptable to 1 or 2-phase operation and electronic control
Typical applications — servomechanisms, remote switching and positioning devices, and pen drives.



OYAE

Specifications:
Rated horsepower .0055 to .04
Length ..... 3-1/8" plus shaft
Dimensions ..... 3-7/8" x 3-7/8"
Remarks .Adaptable to 1 or 2-phase operation and electronic control
Typical applications—servomechanisms, recording instruments and automatic weighing machines.

A-C SHADED POLE SYNCHRONOUS MOTORS

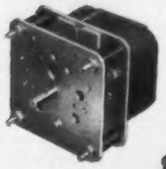


DYAJ — KYAJ

Specifications:
Rated horsepower .0043 to .0086
Length 1-3/4" to 2-1/8" plus shaft
Dimensions .. 2-11/32" x 2-19/32" or 2-23/64" x 2-19/32"
Remarks ...Develop 30 times power of ordinary clock motors
Typical applications—oscillographs, scoreboard timers, viscometers, facsimile recorders, x ray timers, and microfilm cameras.

A-C GEARED MOTORS

SYNCHRONOUS UNIDIRECTIONAL
REVERSIBLE

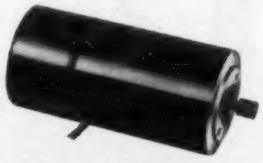


DOUBLE-PLATE

ENCLOSED TYPE

Barber-Colman a-c geared motors provide ratios from 4:1 to 1,333,800:1. Heavy duty gears and output shaft plus long life lubrication add to the reliability of these geared motors.

A-C 400-CYCLE MOTORS



AYLO

Specifications:
Type . . Split-phase capacitor, squirrel cage rotor
Rated horsepower . . . up to 40 mhp intermittent duty
Voltage . . . . . 115 V a-c
Rated speed . . . 9500 to 11,000 rpm
Length . . 2.20" excluding shaft and brake
Diameter . . . . . 1.50"
Brake . . . . 400-cycle brake optional

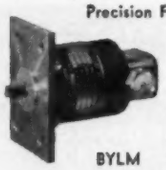
A-C & D-C TACHOMETER GENERATORS

For Commercial Installations

DYAE

Type DYAE a-c reversible shaded pole motor acts as a low-cost, rugged, accurate, and dependable a-c tachometer or rate generator.

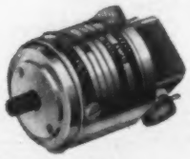
Precision For Military Usage



BYLM

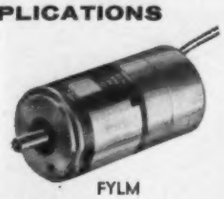
BYLM and FYLM generators are capable of output voltages up to 40 volts per 1000 rpm, with high linearity and low ripple content. Excellent for servo rate feed back.

6-115V D-C PRECISION PERMANENT MAGNET, REVERSIBLE MOTORS FOR AIRBORNE AND INDUSTRIAL APPLICATIONS



BYLM

Specifications:
Rated horsepower . . . . . up to 0.1 intermittent duty
Rated speed . 5,000 to 20,000 rpm
Power input . . . . . 7 to 155 watts
Length . . . . . 2.19" to 3.19" excluding shaft
Diameter . . . . . 1.50"

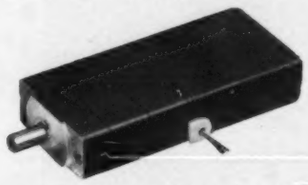


FYLM

Specifications:
Rated horsepower . . . . . up to .055 intermittent duty
Rated speed . 5,000 to 20,000 rpm
Power input . . . . . 2 to 70 watts
Length . . . . . 1.77" to 2.40" excluding shaft
Diameter . . . . . 1.25"
Features . constant brush pressure; R3 bearings; 3/16" dia. shaft.

DYLM — EYLM

Specifications (EYLM only):
Rated horsepower . . . . up to .055 intermittent duty
Rated speed . 5,000 to 20,000 rpm
Power input . . . . . 7 to 155 watts
Length . . . . . 1.83" to 2.45" excluding shaft
Diameter . . . . . 1.38"
DYLM is a split series motor in the same envelope.



GYLM with Matching gearhead

Specifications:
Rated horsepower . . . . . up to .040 intermittent duty
Rated speed . . 2,000 to 24,000 rpm
Power input . . . . . 3 to 60 watts
Length . . . . . 1.97" excluding shaft and gearhead
Diameter . . . . . .75" x 1.63"
Remarks . . . Rectangular gearhead optional, as illustrated.

HYLM

Typical Specifications (27 volts):
Horsepower . . . . . .018 intermittent duty
Torque . . . . . 1.0 oz-in.
Speed . . . . . 17,000 rpm
Power input . . . . . 23 watts
Length . . . . . 1.59"
Diameter . . . . . 1.00"

GEARHEADS, BLOWERS, RIGHT-ANGLE DRIVES, FILTERS, GOVERNORS, MAGNETIC BRAKES

Barber-Colman d-c motors can be adapted to a variety of uses. Several sizes and styles of blowers and gearheads are available. Right-angle drives and multiple-shaft outputs can also be had for special applications. Radio noise filters, governors, or magnetic brakes furnished if required.

D-C BATTERY-OPERATED MOTORS

BYQM

Voltage range . . . . approx. 3 to 30
Governed speed approx. 1200 to 6000 rpm
Torque . . . . . 0 to .20 oz-in.
Maximum dia . . . . . 1.29"

HYQM

Voltage range . . . . . 4.5 to 30 volts
Governed speed 1500 to 5000 rpm
Torque . . . . . 0 to .20 oz-in.
Maximum dia . . . . . 1"

BARBER-COLMAN COMPANY
Dept. T, 1910 Rock Street, Rockford, Illinois

Circle 82 on Reader-Service Card for more information

MATERIALS

Temperature-Indicating Coatings 342

Fourteen new temperature-indicating coatings bring the total number of standard "Tempilaqs" to 100—covering the range from 100 to 2500F in systematically spaced intervals. In the region from 100 to 350F, indicators now become available in 6- or 7-deg steps. Engineers and technicians in the electronics field, as well as in the plastics, rubber, pharmaceutical and food-processing industries, will find the indicators a convenient and accurate means of determining temperatures in their working range.

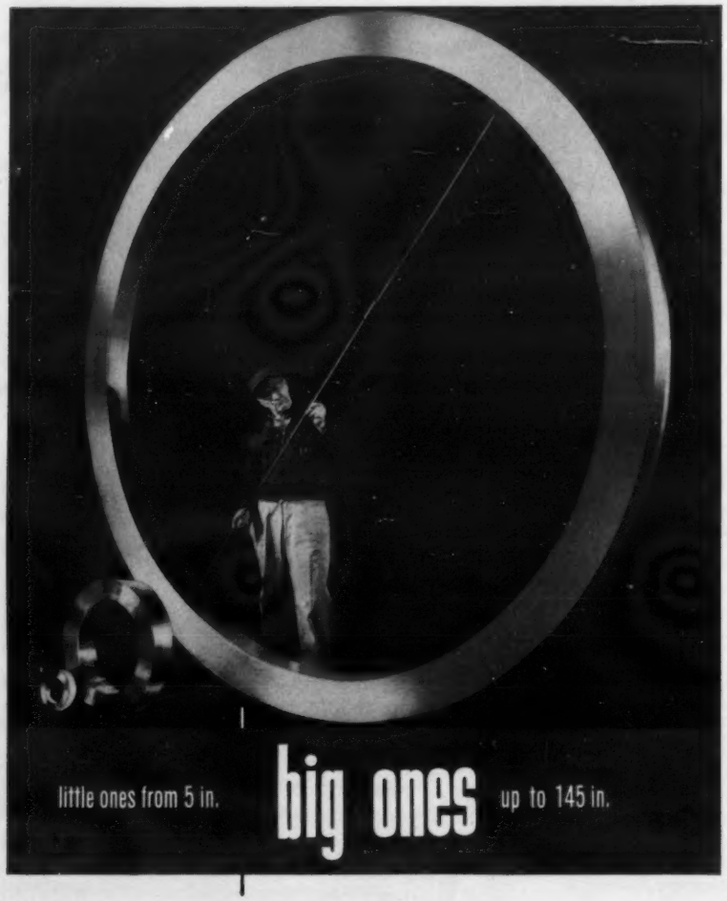
Tempil Corp., 132 W. 22nd St., New York 11, N.Y.

Stainless Steel 343

A new type of stainless steel with improved weldability offers strength and corrosion resistance expected to be equivalent to that of any AISI Type 300 series stainless of similar alloy content. "Kromarc 55" can be used in the manufacture of parts for elevated temperature service. It is applicable for use in steam turbines where large sections and large-diameter thin-walled pipe are welded together. In these applications, the material can be used in weld rod as well as in the cast or rolled sections being joined. It also is suitable for joining other austenitic stainless steels such as AISI Type 316. This stainless can be applied where weldability and strength at temperatures up to 1200F are required, and where large sections must be welded such as in petroleum and chemical processing equipment. Thin sections, such as those used in vacuum systems, are readily weldable by conventional fusion welding techniques. Another possible application for this alloy is at extremely low temperatures in the cryogenic range down to −452F. In composition, the alloy combines a 100-percent austenitic alloy with high ductility, crack-resistant welds and crack-free base metal. The steel consists of 16 percent chromium, 20 percent nickel, significant amounts of manganese and molybdenum and smaller amounts of silicon, carbon and other impurities, in addition to iron.

Westinghouse Electric Corp., Materials Mfg. Dept., Box 128, Blairsville, Pa.

How to buy steel rings . . .



consult with experienced maker

Find out about his background . . . experience . . . manufacturing facilities . . . how close he can come to meeting your specifications . . . what engineering assistance he can provide.

put your plans in his hands

When you have found this experienced, reliable supplier, send him your drawings. Give him complete details on materials, shape, tolerances you require, nature of application, and the performance you expect.

then let him assist you

If Edgewater is your choice, you will find that we will follow your specifications exactly. If required, we can furnish engineering assistance and suggest the material, shape and size to give you the ultimate in performance and economy.

want more details? Write for the Edgewater brochure, which describes our facilities, know-how, and range of sizes and shapes.

Edgewater Steel Company
P.O. Box 478 • Dept. DN • Pittsburgh 30, Pa.

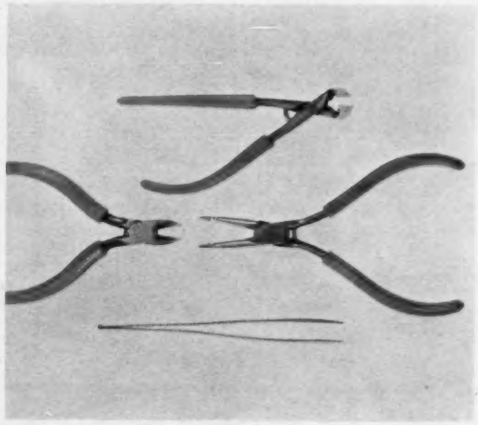
Circle 83 on Reader-Service Card for more information

Plotting Scale Replaces Graph Paper 344

A new graphing instrument called "Alsrule" converts a plain sheet of paper into a custom plot with linear or logarithmic scales of any length, number of cycles, scale modulus or configuration. The rule is a simple plastic chart, measuring 4 by 8 inches, with a variety of scales provided on both sides. Twelve log cycles, ranging from 3/4 to 4 inches, and three linear scales are arranged around the periphery for direct plotting use. Two triangular charts—one linear and one logarithmic—provide an infinity of precision-divided scales of varying moduli. Graphs can be made to fit any space. Custom scale ranges, cycles and boundaries are established easily and points plotted directly with this versatile ruler.

Technical Marketing Associates, Inc., Concord, Mass.

Wire and Ribbon Cutter Kit 345



A plastic carrying case holds five tools for use in welded electronics fabrication. Model 101 matrix cutter, Model 102 component lead cutter, Model 103 utility cutter, Model 104 smooth-tip tweezers and Model 104S serrated-tip tweezers make up the kit. Cutters provide flush-cutting action at the tips, which also feature a back-relieved design for longer life. Material is tarnish-resistant tool steel with heads and shoulders fully polished. Colored cushion-grip handles are of special shape to reduce hand fatigue. Tweezers are nonmagnetic, brush-finished, stainless steel. Tools may be ordered individually.

Sippican Corp., Box 537, Marion, Mass.

IT PAYS TO HAVE HUBBELL COLD CONNECTIONS

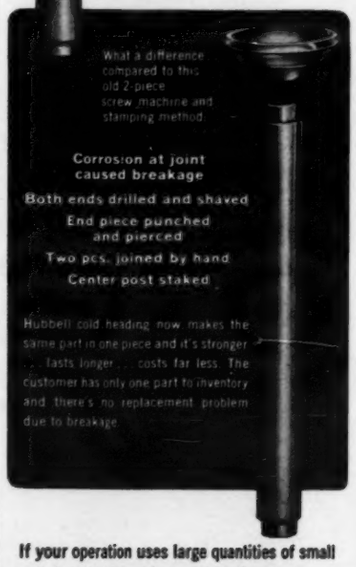
COLD HEADING does it again!

Redesigned for Hubbell Cold Heading, this Brass Switch Handle is

STRONGER MORE EFFICIENT BETTER LOOKING

and only

1/2 THE COST!

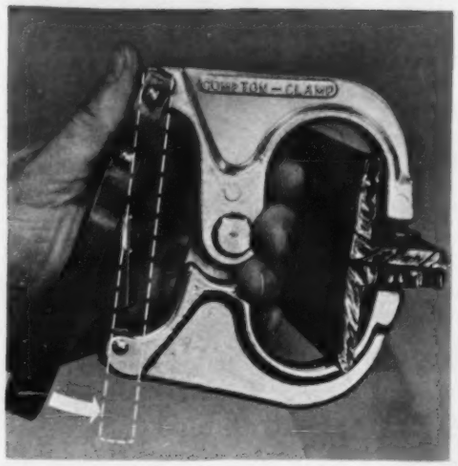

What a difference compared to this old 2-piece screw machine and stamping method
Corrosion at joint caused breakage
Both ends drilled and shaved
End piece punched and pierced
Two pcs. joined by hand
Center post staked
Hubbell cold heading now makes the same part in one piece and it's stronger . . . lasts longer . . . costs far less. The customer has only one part to inventory and there's no replacement problem due to breakage.

If your operation uses large quantities of small metal parts formed on automatic screw machines, equal or greater savings may be possible with Hubbell Cold Heading.

HARVEY
HUBBELL,
INCORPORATED
MACHINE SCREW DEPARTMENT
BRIDGEPORT 2, CONNECTICUT

Circle 84 on Reader-Service Card

C-Clamp 346



A one-hand-operated, over-center, locking-type C-clamp has the ability to lock around two pieces of angle with a firm grip, even on nonparallel surfaces. The clamp opens to 2-1/2 inches and will clamp to a thickness of 3/4 inch. Other features are its replaceable self-aligning pads; its nonslip adjustment mechanism, and its long service life.

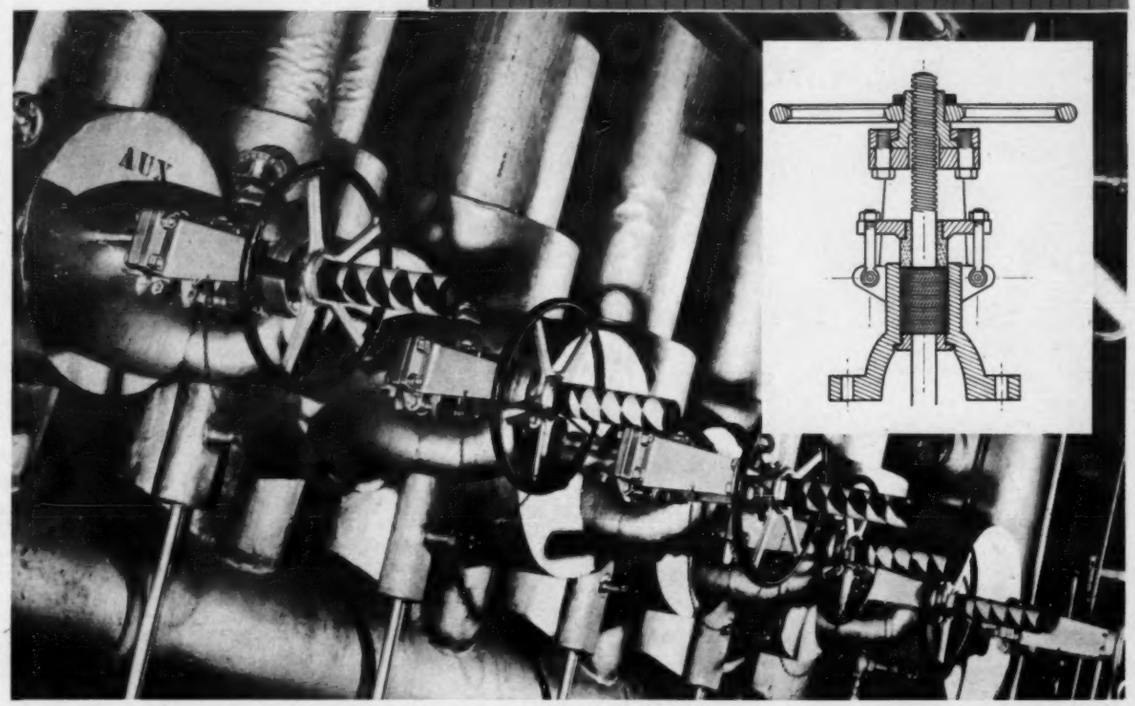
Price & Rutzebeck, Box 30, Hayward, Calif.

Pocket-Sized Unbreakable Magnifier 347

This reading aid lies flat on the page and leaves hands completely free. The unbreakable crystal acrylic magnifier gives automatic focus without distortion. Size is 5-1/2 by 1 inch, enabling easy reading of full-length lines in the average textbook, yet is small enough to carry in pocket. The user easily can read up to five lines at a time, double image.

Franklin Magnifier Co., 1133 Broadway, New York 10, N.Y.

DU PONT TEFLON®



Packings of asbestos and TEFLON® TFE in 7 steam valves stopped leakage...reduced maintenance...saved $280 per year

CAN YOU AFFORD NOT TO USE TEFLON?

Packings made with TEFLON are your logical and most economical choice whenever severe environmental conditions are encountered, AND in all cases when you want—

... greatly reduced packing maintenance

... reduction of replacement costs

... reduced cylinder and shaft wear

... greater standardization with reduced packing inventories

... the competitive advantage of quality and dependability

If any of these considerations are important to your design, the choice of any other kind of packing material might well be wasteful.

The packings: asbestos impregnated with a Du Pont TEFLON TFE-fluorocarbon resin. The application: main distribution control valves on the boiler header shown above, handling steam at 150 psi. and 356°F. The performance advantages: the packings do not leak . . . do not need retightening . . . last indefinitely . . . valves turn easily without "persuaders". Unlike oil, grease and graphite additives, which squeeze out and leave a dry, abrasive base, the impregnations of TEFLON make a lasting mechanical bond with the asbestos. The cost savings: average savings per valve of $10 per year on repacking and retightening formerly necessary, and $30 per year formerly lost through leaking steam —a total of $280 per year for the 7 valves.

Under more severe service conditions, TEFLON resins are often the only answer. These materials are inert to virtually all chemicals and solvents, at temperatures from –450°F. to 500°F.

Consult your supplier about the many constructions available in packings made with TEFLON. Write for the new booklets: "Packings for Valves and Pumps", and "Designing with TEFLON". Address: E. I. du Pont de Nemours & Co. (Inc.). Dept. DN-818. Room 2507T. Nemours Building. Wilmington 98. Delaware. **In Canada:** Du Pont of Canada Limited. P. O. Box 660, Montreal. Quebec.

DU PONT REG. U.S. PAT. OFF.

TEFLON® FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

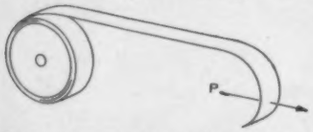
Circle 85 on Reader-Service Card for more information

the NEG'ATOR Data Book

HUNTER Springs for Industry

2. EXTENSION SPRINGS

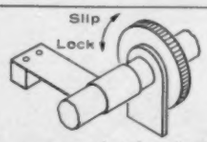
Using NEG'ATOR Extension Springs to Push, Pull, Lift, and Return



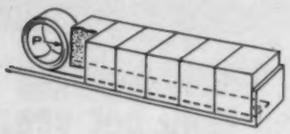
1. The NEG'ATOR spring is a strip of spring steel formed into a prestressed coil. It resists uncoiling with a uniform pull—provides a truly constant-force spring of practically unlimited length.

2. Used to *counterbalance*, provide *tension*, or act as a *retracting device*, it saves space and weight and eliminates cumbersome linkages. Here, two springs are used back-to-back as a counterbalance.

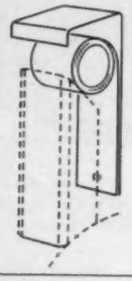
3. NEG'ATOR bands are used as oscillating *motion transmitters* to replace gears and cables. They eliminate backlash and slippage and provide smooth, quiet operation with many turns per cycle.



4. As a one-way clutch or brake, the NEG'ATOR prevents counter clockwise rotation of shaft as spring tends to grip more tightly. Clockwise rotation expands coil, lets shaft slip.

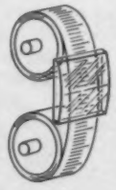


5. Used as a feeding device for data cards or merchandise, the NEG'ATOR spring saves space and acts over a long range. The coil pushes with unvarying force all the way.



6. The NEG'ATOR spring makes an ideal *constant-pressure* device. Used in this manner, it eliminates mechanisms for "setting-up" commutator brush springs, for example. In addition, it saves space, and cuts costs.

7. The surface of a NEG'ATOR spring can be printed and used to provide a scale of great length in a small space. Because each end tends to wrap around its bushing, the band acts as a "balanced" self-coiling scale.



How to use it?

■ Window sash balances, vending machines, compression testers, commutator brush holders, door closers, duplicating machines and countless other mechanical and electrical products employ NEG'ATOR extension springs. Write for literature.

The NEG'ATOR spring is a development of Hunter Spring Company.

HUNTER

HUNTER SPRING COMPANY
A Division of American Machine and Metals, Inc.
10 Spring Avenue, Lansdale, Pennsylvania

DIVISIONS OF AMERICAN MACHINE AND METALS, INC.: Troy Laundry Machinery • Riehle Testing Machines • De Bothezat Fans • Tolhurst Centrifugals • Filtration Engineers • Filtration Fabrics • Niagara Filters • United States Gauge • Rahm Instruments • Lamb Electric Co. • Hunter Spring Co. • Glaser-Steers Corp.

Circle 86 on Reader-Service Card for more information

EQUIPMENT

Metals Tester 348

Hardness of either soft metals or steel may be measured with this inspecting device. The unit is shown as a standard bench-type tester for small parts; removed from the stand or frame, the main body can be equipped with hand grips for checking hardness of large objects, even those with complicated contours. Measurement of aluminum and copper with a thickness of more than 0.6 mm is possible. Readings are given in both Vickers (40-1000) and C scales (20-70). Standard accessories are a flat anvil, V-anvil, inclined bed and gage, and indenter adjusting tool. Height with stand is 10-1/2 inches. A U-shaped clamp and other accessories for use in testing inside surfaces of parts, such as cylinders, also are obtainable.

Radio Corp. of America, Industrial and Automation Div., 12605 Arnold Ave., Detroit 39, Mich.

FLEXIBLE TUBING
Heavy Duty Interlocked
RUGGED AND STRONG FOR LASTING SERVICE
. . . that is Penflex Flexible Tubing. Especially engineered for punishing industrial service . . . to defy abrasion, crushing, heat in conveying liquids, chemicals, powders, granular material, semi-solids.
Penflex makes all types and sizes (1/8" to 24" I.D.) for every industrial application. For catalog and details write to Pennsylvania Flexible Metallic Tubing Co., Inc., Route 30, Paoli, Pa.
Penflexweld Corrugated
PENFLEX
TIGHT AS A PIPE BUT... FLEXIBLE

Circle 87 on Reader-Service Card

Letter Opener and Scale 349

This handy device weighs and opens letters and also may be used as a magnifier. Letters up to 3 oz are weighed accurately by placing the envelope in the center of the handle and moving the slide weight out until the blade tilts down. Indicator window and body of the unit are molded of "Lucite" acrylic resin. A "Delrin" acetal-resin spring holds metal weight in place.

E. I. du Pont de Nemours & Co., Wilmington, Del.

Circle 88 on Reader-Service Card

OPENING NEW HORIZONS

. . . in economical power application

98% PLUS OPERATING EFFICIENCY
MORE POWER PER CYLINDER DOLLAR
PROVEN LEAKPROOF OPERATION
GREATEST SELECTION EVER OFFERED
SAFE UNDER SEVERE LOADS
SAFE WITH ALL KNOWN HYDRAULIC FLUIDS
SAFE UNDER TEMPERATURE EXTREMES
DAMAGE-PROOF PISTON RODS

Flick-Reedy . . . *Winner of "Plant of the Year" Award and "Silver Anvil" Public Relations Award*

Miller

MORE SAVINGS!

Our ultra-modern, new "Plant of the Year" with its special facilities and operating economies enable us to offer an **extra 10% price savings** on our big "stock" selection of:
Model "H" (Hyd.) Cylinders, 1½" through 8" bores;
Model "J" (Hyd.) Cylinders, 1½" through 14" bores;
Model "A" (Air) Cylinders, 1½" through 14" bores.
Strokes up to 36", cushioned and non-cushioned.

Full Details On Request

Miller Hydraulic Cylinders make impossible applications look easy. With Teflon Seals, Case-Hardened Rods (50-54 Rockwell C), Patented "Shef" Tubing End Seals, and other exclusive *standard* features, these cylinders are practically damage-proof, are ultra-dependable under pressure and temperature extremes, and provide leakproof sealing with ALL hydraulic fluids. Built to *exceed* J. I. C. Specifications, these cylinders are achieving new highs in production and operating economies in thousands of plants. Two great lines: Power-Packed Model H for 3000-5000 psi and Job-Rated Model J for 500-2500 psi. All bores, strokes and mounting styles. Big "Stock" selection for immediate shipment at substantial savings.

Write for literature.

R

MILLER FLUID POWER

DIVISION OF FLICK REEDY CORPORATION

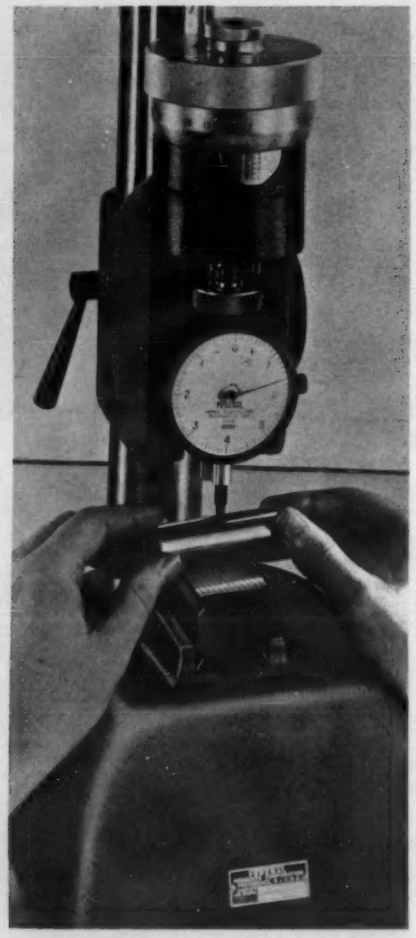
7N020 York Road, Bensenville, Illinois.

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

Multichoice Comparator 350

Offering a wide selection of gaging methods and accessories, Model 100 B-40 is a sturdy base and precision column on which can be assembled any of several dial gaging units or air, electric or electronic gage heads. A variety of interchangeable reference surfaces increases adaptability of the comparator. One useful combination features a micrometer head with a 0.0001-inch dial indicator. Alternative holding arm has a fine adjustment with no play or backlash. Choices of reference surfaces are reversible anvil, serrated platen, roller V-block and precision centers.

Federal Products Corp., Providence 1, R.I.



PRODUCT BY ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

PROCESSING BY NSE

PRE-PAINT PROTECTION BY
AMCHEM ALODINE*

This gleaming hangar facility of Scandinavian Airlines System at N.Y. International Airport features a tough, baked enamel Alumalure finish over strong, lightweight aluminum—Alodine treated for additional corrosion resistance and paint longevity.

How Amchem Pre-Paint Treatment, NSE Processing Help Put the "Lure" in Alcoa Alumalure!**

Alcoa Alumalure baked enamel finish on industrial roofing and siding sheet has made a startling impact in building circles. A low cost, decorative, maintenance-free exterior wall surface, available in 11 colors, it is widely used for new buildings as well as remodeling older structures.

Key to Alumalure success—strong, light aluminum and design innovations by Alcoa . . . precision finishing by NSE Signs & Stampings . . . unmatched protection and paint adhesion by Amchem Alodine chemicals.

With color matching standards a prime-requisite, assurance of paint adhesion on Alumalure sheets is a vital necessity to protect customers who buy the product, months later reorder and expect exact color match. Results to date on millions of square feet of Alumalure processed—no paint failure or rejects involving chemical treatment by Alodine!

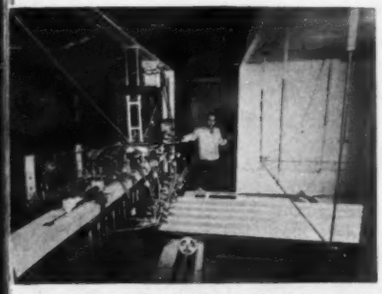
Rigid quality control has resulted in a fine production record for Alumalure at NSE's Birmingham plant.

Full time NSE and Alcoa inspectors watchdog every foot of sheet throughout the production cycle. For chemical pre-treatment Alcoa specifies high standards of Government Specification MIL-C-5541. NSE selected and uses Alodine for "the best metal preparation treatment you can find." NSE management states emphatically, "There's no question about what Alodine has done for the preparation of aluminum for painting. We don't have paint failures. We don't have customer rejects."

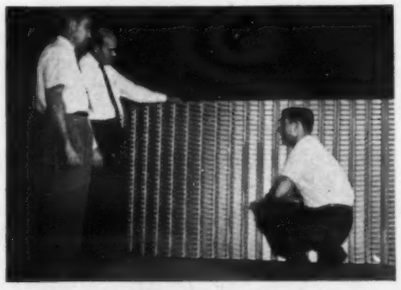
An "extra" plus from Alodine—Alcoa finds additional customer appeal in the gold coat Alodine creates on Alumalure backing which provides a pleasing antique decorative finish for building interiors.

If you want—corrosion resistance, lasting paint adhesion, rejects slashed to the vanishing point and sales ammunition that helps sell products—investigate Alodine, the industry's first and today's standard conversion coating chemical for aluminum!

* Amchem's trademark for its conversion chemical coating for aluminum.
** Trademark of Aluminum Company of America.



After treatment with Alodine, a ribbed siding sheet is painted employing Ransburg electrostatic paint equipment. NSE can run two sheets in tandem, accomplishing 60-lineal feet per minute painting.



NSE Executive Vice-President John Montgomery (left), Plant Manager R. Cater Lee, and Alcoa (quality standards) specialist J. Shea (right), inspect "3D" Alumalure sheet.

The massive equipment shown here is an ultra-modern, newly installed Lanly oven for handling Alumalure sheets.

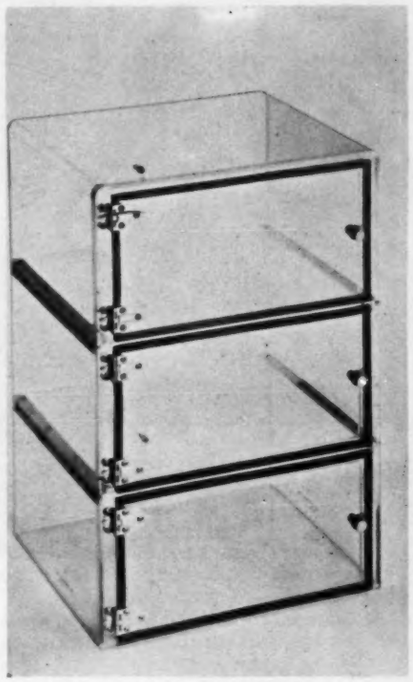
AMCHEM **ALODINE**

Amchem is a registered trademark of
AMCHEM PRODUCTS, INC. (Formerly American Chemical Paint Co.)
AMBLER, PA. • Detroit, Mich. • St. Joseph, Mo. • Niles, Calif. • Windsor, Ont.

Write for free bulletin 142C, outlining the uses and many different types of Alodine available for aluminum fabricators and processors.

Circle 89 on Reader-Service Card for more information

Transparent Storage Cabinets 351

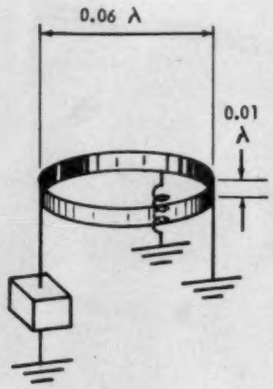


Fabricated from 1/4-inch clear "Plexiglas", air-control storage cabinets protect delicate parts, components and miniature gages from dust, moisture and other harmful atmospheric conditions. Transistors, bearings and other sensitive parts can be stored between production operation or before final assembly and packaging. Each cabinet has separate storage areas which can be purged individually with dry or inert gas. Three cabinet sizes are offered: a one-door model, measuring 12 by 12 by 12 inches; two-door cabinet, 16 by 18 by 18 inches, and three-door unit, 16 by 27 by 18 inches. Other sizes are custom made to fit individual requirements.

Air Control, Inc., 450 Narberth Ave., Narberth, Pa.

Citizens Band Antenna 352

A newly designed ring-type CB antenna improves performance of two-way radio for citizens band use by elimination of fading, fatigue and blind spots. The antenna permits good operation in lower waveband ranges, full gain even at high vehicle speeds and full omnidirectional coverage in the horizontal plane. Of value in areas where the commonly used waveband range is overcrowded, the unit permits



OMNI-SLOT ANTENNA

high-quality reception at frequencies that cannot be utilized by some conventional equipment. Other features include rapid installation, little or no maintenance and easy transfer to another vehicle. Three models are offered: 12-inch-dia unit, 50-157 mc; 18-inch-dia model, 35-108 mc; and 24-inch-dia antenna, 25-60 mc. Each unit is only 2 inches high.

General Electromagnetics Corp., 11719 E. Washington Blvd., Whittier, Calif.

Circle 90 for Reader Service

ZE10A—with high welded joint strength—is ideal for making light, strong containers like the Tote Bin (right), built by Tote Systems, Inc., Beatrice, Neb., a subsidiary of Hoover Ball and Bearing Co.

NEW DOW MAGNESIUM ALLOY ZE10A . . .

high welded joint strength and no stress relief!

New Dow magnesium alloy ZE10A needs no post-welding stress relief. This strong sheet alloy is tailor-made for fabricating containers, truck bodies and other large structures. And it's ideal for field repair operations where stress relief can be a real problem.

ZE10A also offers the advantage of very high welded joint strength, a matter of importance in butt welding. The result is strong, stiff, welded containers which are extremely light in weight . . . with greater capacity, pound-for-pound, than containers made from any other metal! And ZE10A provides maximum dent resistance.

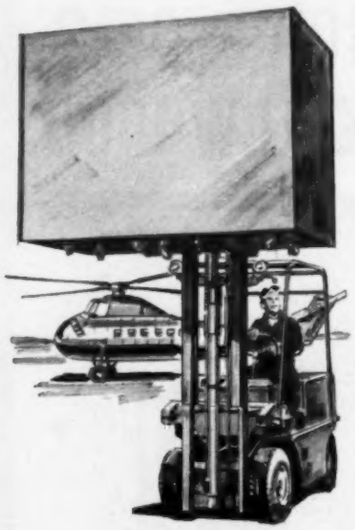
When welding ZE10A magnesium sheet to extrusions, use Dow magnesium extrusion alloy ZK21A. *Neither* alloy requires stress relief after welding. For further information and data on Dow magnesium alloys, write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Department 1112AV8-18.

DOW

THE DOW METAL PRODUCTS COMPANY
Division of The Dow Chemical Company

DOW

HOW MAGNESIUM NO-RIB DESIGN CUTS CONTAINER COSTS AND WEIGHT



Cargo containers can be made both strong and light . . . and at less cost . . . with magnesium no-rib design. Fabricated from stiff sheets of lightweight magnesium, container walls need no stiffening ribs or supports.

No-rib design eliminates costly, time-consuming installation of ribs and fasteners . . . provides strong, dent-resistant walls that are smooth inside and out . . . produces economical containers that, pound-for-pound, have greater cubic capacity than ribbed containers of any other metal.

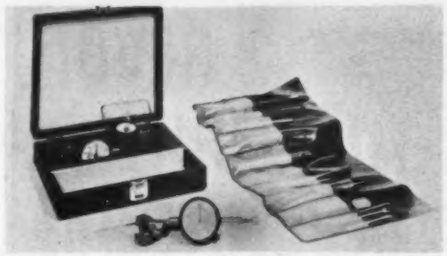
Dow magnesium sheet alloy ZE10A is ideal for no-rib construction. It provides high welded-joint strength and *needs no stress relief* after welding. For equipment handling and cargo containers, storage bins, vehicle bodies, magnesium no-rib construction offers maximum strength at lightest weight . . . and savings in construction time and costs!

DOW

THE DOW METAL PRODUCTS COMPANY
Division of The Dow Chemical Company
Midland, Michigan

Circle 90 on Reader-Service Card

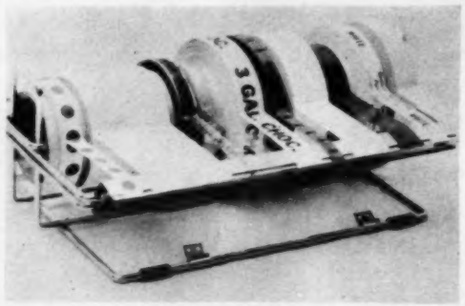
Instrument and Tool Kits 353



Designed for maintenance of complex electromechanical switching devices, the SF-80 and SF-90 instrument and tool kits may be used also in general maintenance of relay matrices, stepping-switch systems, spring-leaf commutators, slip rings and cam-operated switches. Both kits are suitable for repair and adjustment. In addition to containing suitable gram gages and dial indicators, each kit includes a rocker adjusting tool, interposer eyelet tool, probe, needle-nose pliers, pen light, tweezers, shims, various wrenches and a set of screwdrivers. The compact carrying case measures 11 by 8-1/2 by 3 inches and total weight of the kit is approximately 4 lb.

James Cunningham, Son & Co., Box 516, Rochester 8, N.Y.

Multiroll Tape Dispenser 354



Adaptable to both 1- and 3-inch tape roll cores, this versatile dispenser can be either portable or stationary. Razor-sharp cutting blade along the front of the unit severs tape accurately with only slight finger pressure. The device is equipped with a standard removable bar mandrel for holding the 3-inch cores; an extra wooden mandrel for accommodating 1-inch cores is obtainable on request. Thirteen 3/8-inch-wide empty roll cores separate tapes and keep them spaced uniformly. Spring clips are included for fastening dispenser to horizontal surface (work table) or vertical surface (wall). Overall measurements are 15-1/2 by 9-3/4 by 6 inches and weight is 6 lb. Finish is nickel-chrome plate.

Noel Mfg. Co., Inc., 1415 S. Meeker Ave., Muncie, Ind.

bearings and parts

Take the simple, sure, direct route to lower manufacturing and maintenance cost. Design into your product Bunting Standard Stock Bearings. You avoid inventory investment, delays, confusions, production problems by the immediate availability in small or large lots, from local distributors all over America, of hundreds of different stock sizes of completely finished cast bronze and sintered bronze bearings and bars, aluminum bars and Nylon shapes.

Special design bearings not obtainable from stock can be procured immediately at low cost from Bunting fully equipped machine shops in five industrial centers. The wide range of sizes of Bunting Stock Cast Bronze and Sintered Bronze Bearings makes the alteration of a stock item to a special bearing easy and economical. Bunting Cast Bronze, Sintered Bronze, Aluminum Bars and Nylon shapes provide the materials for special requirements which cannot be made from stock bearings. Your local Bunting Distributor can arrange for such work.

A large staff of bearing engineers in the field stands ready to assist in the use of these Bunting stock products and in the designing of bearings or components for extraordinary applications. Two big, modern plants assure ample production capacity at all times for bearings and parts made from all modern metals and materials.

See Bunting's complete catalog, Sweets Product Design File 11C/BU or ask for Bunting's General Catalog, Form 158; Nylon Catalog, Form 32; Technical Handbook on Bunting Nylon, Form 33; The Technology of Bunting Aluminum, Form 46; Engineering Handbook of Powder Metallurgy, Form 1; Bunting Machine Shop Service, Form 4.

The BUNTING Brass and Bronze Company
TOLEDO 1, OHIO
BRANCHES IN PRINCIPAL CITIES

Circle 91 on Reader-Service Card for more information

Printed-Circuit Test Kit 355

A low-cost kit that contains sufficient materials for making a limited number of printed-circuit masters is now available. Purpose of the kit is to introduce the "Cut'N'Strip" method by enabling user to make several sample printed-circuit masters and compare costs and advantages with other techniques. According to the manufacturer, the new method represents one of the most efficient ways of making circuit masters. Pads and runs are dependably accurate—there is no ink to run, no tape to stretch, pile up, shrink or pull away on curves. In many cases (it is claimed) all intermediate photography can be eliminated. Each kit contains two sheets of film, pencil chuck (Staedtler drafting pencil with lead), cutting blade insert, an illustrative printed-circuit brochure and complete, easy-to-follow instructions.

Keuffel & Esser Co., Third & Adams Sts., Hoboken, N.J.

HERE IS THE **NEW** REVOLUTE **ROCKETTE**
THIS **VERSATILE** WHITEPRINTER BRINGS
YOU FAMED **REVOLUTE QUALITY**, FULL 42"
PRINTING WIDTH, YOUR CHOICE OF **3**
MODELS-AT PRICES THAT START **BELOW $1600**

here's good news

for the company or department that "couldn't afford" a big-production whiteprint machine. You can now! These new Rockettes start below $1600. Yet look what they offer—*compare* what they offer with any other whiteprinter made:

- Full 42" printing width.
- Your choice of wattages and printing speeds: 30, 40, or 60 watts...15, 25, or 35 fpm.
- Revolute's exclusive perforated roller developing unit. Shortens print travel, saves ammonia. Assures fast print return, uniform print quality.
- Automatic developer control. The Rockette has an automatic pump as standard equipment.
- Table-top or floor stand model, as you prefer.

If you know Revolute, you know it stands for the very best. Yet here is this new Revolute Rockette, priced with the very lowest! For the full story of specifications and costs—simply mail the coupon.

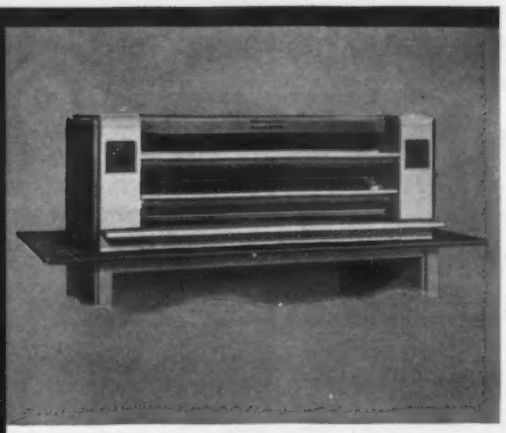
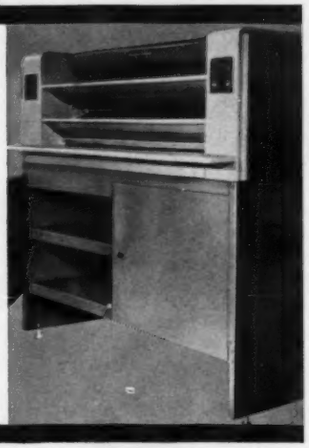
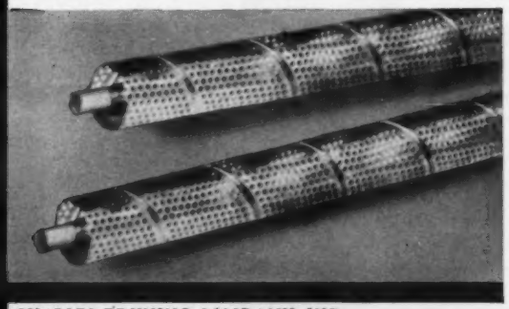


TABLE-TOP ROCKETTE has all the performance features of the floor stand model: three printing speeds, each with automatic developer control.



ROCKETTE FLOOR STAND provides deep, roomy storage area for sensitized material supplies.

PERFORATED ROLLER DEVELOPING UNIT ...a Revolute exclusive...assures uniform print quality, fast print return.



For better prints and copies.

diazo

CLEARLY, YOUR CHOICE IS

PARAGON REVOLUTE A DIVISION OF BRUNING

CHARLES BRUNING COMPANY, INC.
1800 West Central Road, Mt. Prospect, Illinois DN-8
In Canada: 103 Church St., Toronto 1, Ontario
☐ Please send further information on your new Rockette whiteprinter
☐ Please have a sales representative contact me

Name Title
Company
Address
City County State

Circle 92 on Reader-Service Card for more information

EQUIPMENT

Personal Radiation Monitor 356

The PRM (a miniature personal radiation monitor) weighs only 3.5 oz and provides continuous audible and visual indication of radiation levels. Worn in the user's pocket, it provides simultaneous chirping sounds and light flashes at frequency intervals in proportion to the amount of gamma radiation present in an area. The sound is near the point of maximum sensitivity on hearing curve, 2800 cps. Two instruments are available, covering both low and high radiation ranges. PRM-1 is most effective

for the range from 1 milliroentgen per hr to 2 roentgens per hr with a continuous wail at higher levels. PRM-2 is most effective for the 10-milliroentgen-per-hr to 200-roentgen-per-hr range, although it provides a proportionate indication from background to 10 milliroentgen per hr and also provides a continuous wail at levels over 200 roentgen per hr.

Nuclear Materials & Equipment Corp., Apollo, Pa.

50,000 HOURS

*of silent, synchronous power assembled in every **

HANSEN SYNCHRON® TIMING MOTOR

Manufacture of long-life, Hansen SYNCHRON Timing Motors is quality-controlled throughout, to make them the *best* synchronous motors for industrial and commercial applications. Skilled, experienced workers assemble Hansen SYNCHRON motors to rigid standards. Each motor undergoes 51 separate tests and inspections before shipment, insuring users of the ultimate in silent, continuous, synchronous power for specific timing applications.

Operating efficiently in any position, self-starting, self-lubricating Hansen SYNCHRON Timing Motors deliver from 8 to 30 in./oz. guaranteed torque; at temperatures from —40 F to +140 F; in speeds from 600 rpm down to ½ rph; clockwise or counterclockwise rotation. Over 200 types of output available.

The efforts of Hansen engineers have been concentrated in just one area for over 50 years — creating and applying synchronous power units to timing applications. Use this experience to solve your specific timing problems. Contact your nearest Hansen representative, or write direct.

HANSEN REPRESENTATIVES:

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ELECTRIC MOTOR ENGINEERING, INC.
Los Angeles, Calif. (OLive 1-3220)
Oakland, Calif.

WINSLOW ELECTRIC CO.
New York, N. Y. • Chester, Conn.
Philadelphia, Penn. • Cleveland, Ohio

*An average figure for Hansen SYNCHRON Motors . . . many are designed for shorter life — others for years longer.

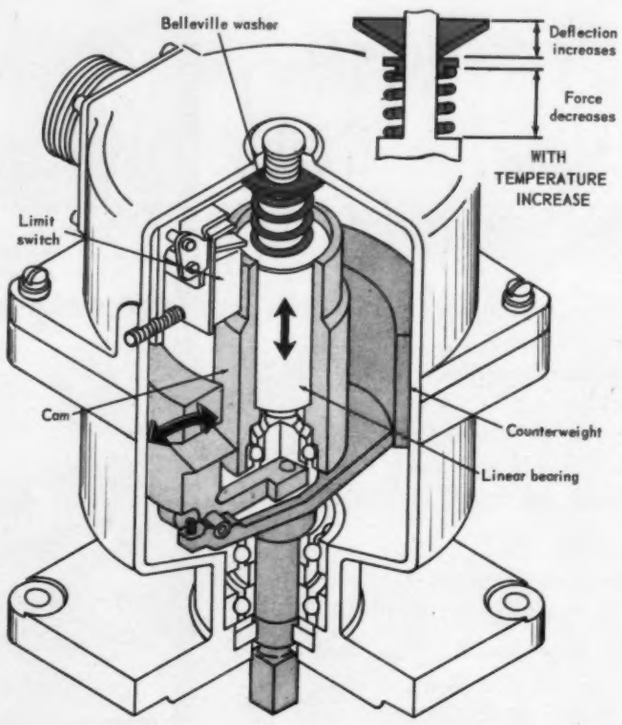
Circle 93 on Reader-Service Card for more information

DESIGN NEWS

DESIGN IDEAS

MATERIALS

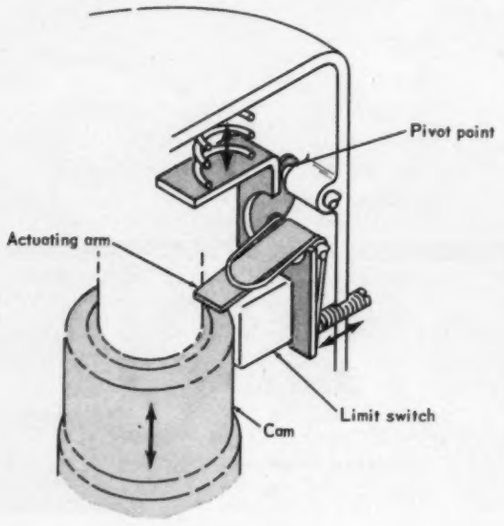
Bimetal Washer Compensates



SPEED-SENSITIVE SWITCH weighs 1.0 lb. Maximum switching deviation is 1.5 percent over temperature range —65 to 400F.

ALL MOVING PARTS mount in antifriction bearings. Because each limit switch operates at different load, bimetal washer deflection can compensate for any one, or can be a compromise of several switches. Design gives no detectable hysteresis.

SET SCREW moves right-angle lever against spring, pivoting limit switch on its mounting. Cam moving axially releases actuator hair spring to move limit-switch button.



Speed Switch for Temperature

Edward W. Schrader, Western Editor

A bimetal Belleville washer compensates for temperature expansion of a coil spring in a speed-sensitive switch. The device senses speed of a rotating shaft by means of a single flyweight mounted on miniature ball bearings.

The bimetal washer opposes spring force. High-expansion material is on the outside; low-expansion material is on the inside of the cone. Deflection varies linearly as a function of temperature.

The coil spring is made of 17-7 PH stainless steel. This material has a uniform reduction of shear modulus as a function of increasing temperature. Since the spring rate varies as the shear modulus, the spring rate reduces with rising temperature; this action is balanced by the greater deflection of the Belleville washer with the rising temperature, so the spring provides a constant force over the temperature range.

As speed increases, the flyweight is thrown into a larger orbit. It is balanced by a fixed weight on the opposite side of the rotating yoke. The movable weight pivots on a bearing in the radial direction as it rotates.

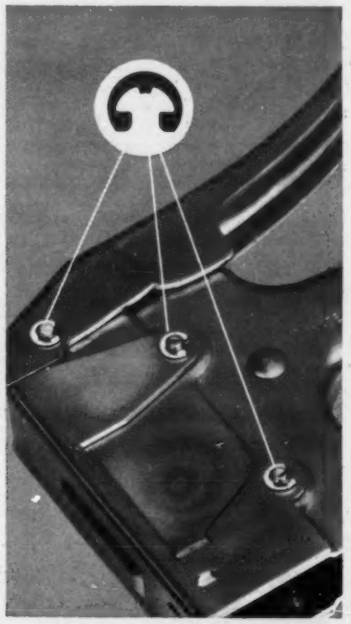
A lever converts radical movement to an axial movement near the centerline of the device. One ball on the end of this lever produces an axial thrust on a cylinderical cam. This cam, in turn, is aligned by means of a cylindrical-type linear ball bearing. Thus, the cam is free to move along the axis of rotation.

A compression spring opposes the linear movement of the cylindrical cam. As the spring force is overcome by the mechanism and the rotating weight, the cam moves to trip limit switches.

The S-10 speed-sensitive switch is a development of Cosmodyne Corp., Hawthorne, Calif.

Here's how ARROW FASTENER Co. gets

Truarc® Retaining Rings FREE!



U.S. PAT. NO. 2,637,812

Mechanized Ring-O-Mat® designed by Truarc Engineers doubles stapler production for saving of $2500/year

Arrow Fastener Co., Inc., Brooklyn, N. Y., uses three Truarc Series 5144 reinforced E-rings to secure components in its Model T-50 compression stapler. Originally, Arrow operators installed the rings by hand with conventional applicators and dispensers. Fast? Sure — but Truarc engineers suggested to the company how the job could be done even faster and more economically by mechanizing the entire ring assembly operation.

Working closely with the Arrow engineering and production staff, Truarc mechanization engineers designed the unique Ring-O-Mat shown above. The unit installs the three E-rings in a single operation, twice as fast as the former hand method. Savings with the equipment are $2500 a year — enough to pay for all the rings the company uses!

Here's how the Ring-O-Mat works. The Truarc rings are supplied in tape-wrapped Rol-Pak® cartridges which are loaded on vertical magazine rails at the center of the unit. To install the rings, the operator merely places the stapler in a nest at the front and pushes the control buttons . . . the Ring-O-Mat does the rest! Applicators connected to the air cylinders grasp the bottom ring in each stack and move forward, seating the rings in accurately located grooves pre-cut in pivot pins extending through the body of the stapler. When the rings are fully seated, the applicators are withdrawn automatically and the operation is completed. Simple, fast, fool-proof — a typical example of how Truarc retaining rings lend themselves to mechanized assembly. A good example also of how you get *more* than a fastener when you buy Truarc!

Interested in getting your retaining rings FREE?

Bulletin 459-13 describes a number of assembly techniques for mass-production ring installation. Write for a copy or see your Truarc representative.

WALDES KOHINOOR, INC.

47-16 Austel Place, Long Island City 1, New York

61-5

WALDES TRUARC® RETAINING RINGS

Circle 94 on Reader-Service Card for more information

An Entirely New Design Concept For the Actuation Engineer!

SAGINAW b/b SCREW WITH TORQUE LIMITER FREE WHEELS AT BOTH ENDS OF ACTUATOR STROKE

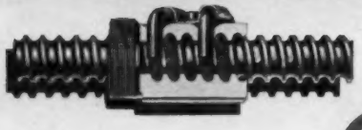
With the introduction of the Torque Limiter for Saginaw Ball Bearing Screws, actuator design has made a significant step forward. That's because the Torque Limiter permits b/b screws to free wheel at both ends of the actuator stroke at normal loads.

Designed to overcome load limitations common to conventional free wheeling b/b screws, the Torque Limiter may be used with any size Saginaw b/b Screw. The only load limitation is the design capability of the basic screw.

Integral stops on the screw shaft precisely control the length of the stroke. When the ball nut reaches either stop, it free wheels. The drive energy is absorbed by the Torque Limiter. Loading may be tension, compression, or a combination of both.

Some areas in which Saginaw b/b Screws with the Torque Limiter can be used are: *Overload Protection* for motors when the actuator reaches travel limits; *Overtravel Protection* in case limit switches fail to stop drive; *Exact Positioning* without other complex positioning systems due to integral stops; *Holding Devices* where drive continues to operate at end of actuator stroke until reversed to release; *Forward-Stop-Reverse Systems* where motors can be smaller and less expensive since instantaneous reversing at drive limits is not required; *Stepless Actuation* for precise, controlled positioning with repeatable accuracy . . . an inherent advantage of all Saginaw b/b screw actuators.

If you have an actuator design problem, we will be happy to help you find the solution. Write, Chief Applications Engineer, b/b Screw and Spline Operation, Saginaw Steering Gear Division, General Motors Corporation, Saginaw, Michigan.



WRITE FOR NEW DATA BOOK

Saginaw ball bearing Screw

Circle 95 on Reader-Service Card for more information

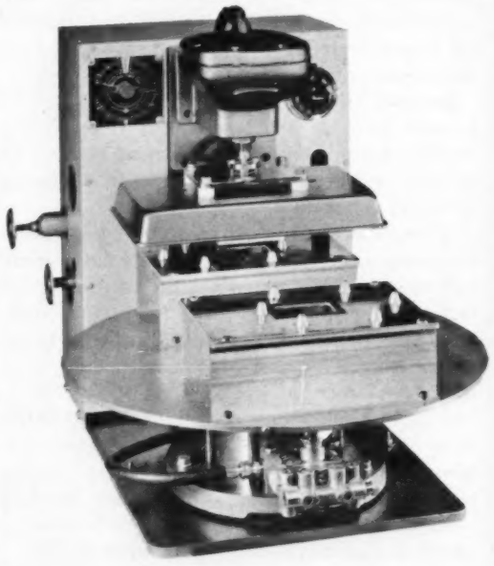
Oilless Rotary

Lars G. Soderholm, Midwest Editor

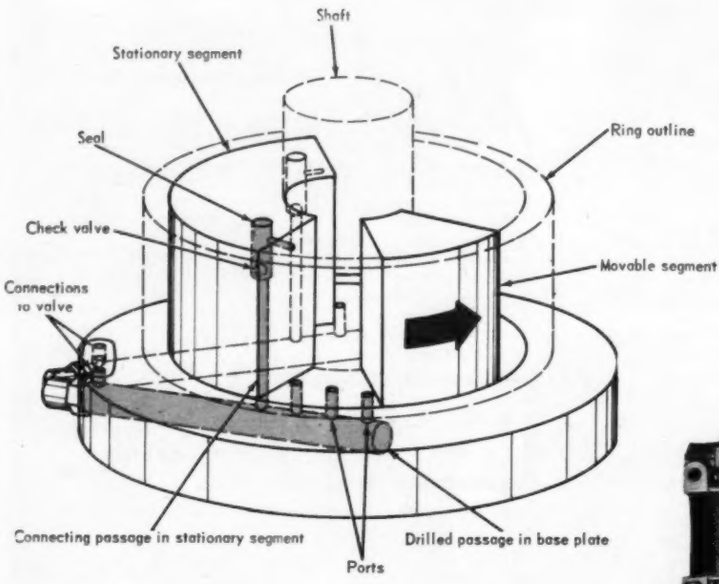
A rotary cylinder uses dissimilar metal bearing surfaces to provide oilless operation. Close-tolerance bearing fits are used to eliminate seals. Precise machining of the stationary and rotary segments of the air cylinder provides accurate 180-deg indexing by the rotary shaft.

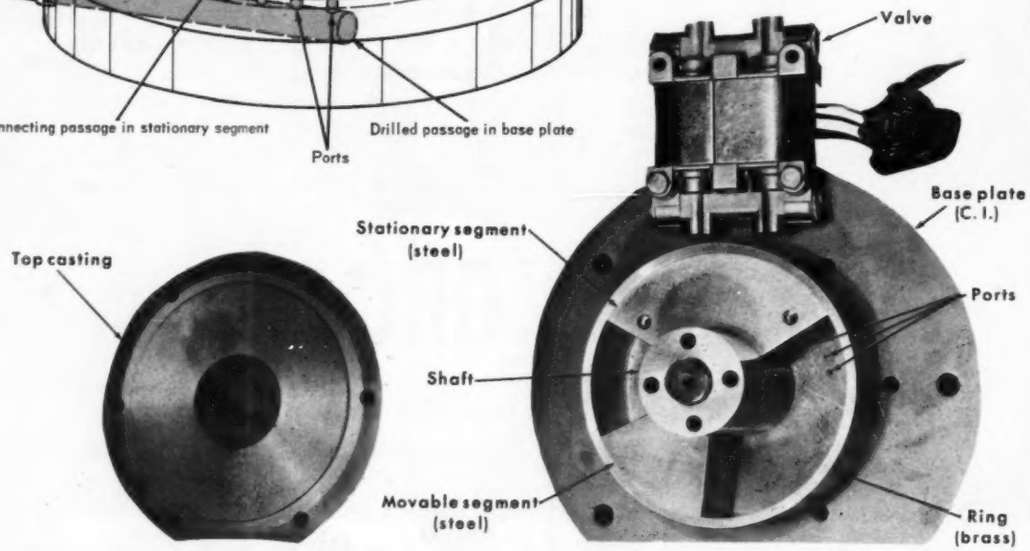
This rotary air cylinder was designed for a specialized use on a plastic-bubble sealing machine. To keep maintenance requirements at a minimum, the rotary cylinder is made to operate without lubrication. The cylinder side plates are made of cast iron and fit on either side of a cylindrical brass ring. Inside the ring there is a steel driveshaft with the steel rotary segment fastened to it. A stationary steel segment is fastened to both the brass ring and side plate and determines limits of movement for the rotary segment.

The cast-iron base plate contains drilled passages leading from a subplate-mounted, four-way air valve to points just beyond the stationary segment. Three ports from each passage open into the air chamber of the cylinder. Other drilled passages meet the drilled passages in the base plate at right angles and are located within the stationary segment. These passages terminate at ball check valves which open into the valve air chamber through small drilled holes.



Cylinder Provides Precision Indexing





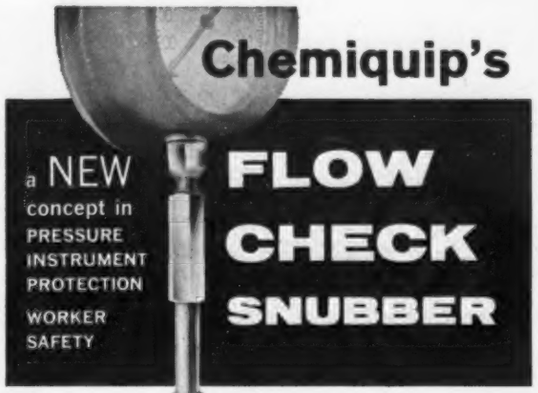
In operation, when pressure is sent to one side of the rotary cylinder, it opens the ball check and starts the rotary segment moving. Continued movement of the segment consecutively opens the three ports which have increasing cross-sectional areas. When travel of the rotary segment is nearly complete, it covers the ports at opposite end in reverse order, reducing the escape area for the trapped air. This provides a cushioning effect at the end of rotation.

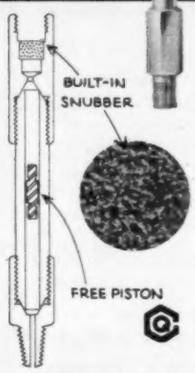
No seals are used in the rotary air cylinder proper. Tolerances between shaft and side plates are from 0.0005 to 0.0013 inch. Clearances between rotary segment and side plates are approximately 0.0015 inch. End clearance of the rotary segment is from 0.0005 to 0.0010 inch.

In its particular application the rotary cylinder is used to index a table located on a high-speed contour packaging machine to seal small items in plastic bubbles. Low-pressure (10 psi) air is used so the operator can hand stop the table if necessary.

Accuracy of indexing is maintained so that a 28-inch-dia table can be positioned at its outer edge to within 0.030 inch of a selected point.

The rotary air cylinder is used on the Clear-Pak Jr. plastic-bubble sealing machine made by the Erdco Engineering Corp., Addison, Ill.





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DESIGN DATA NEWS

Torque—Angular Acceleration

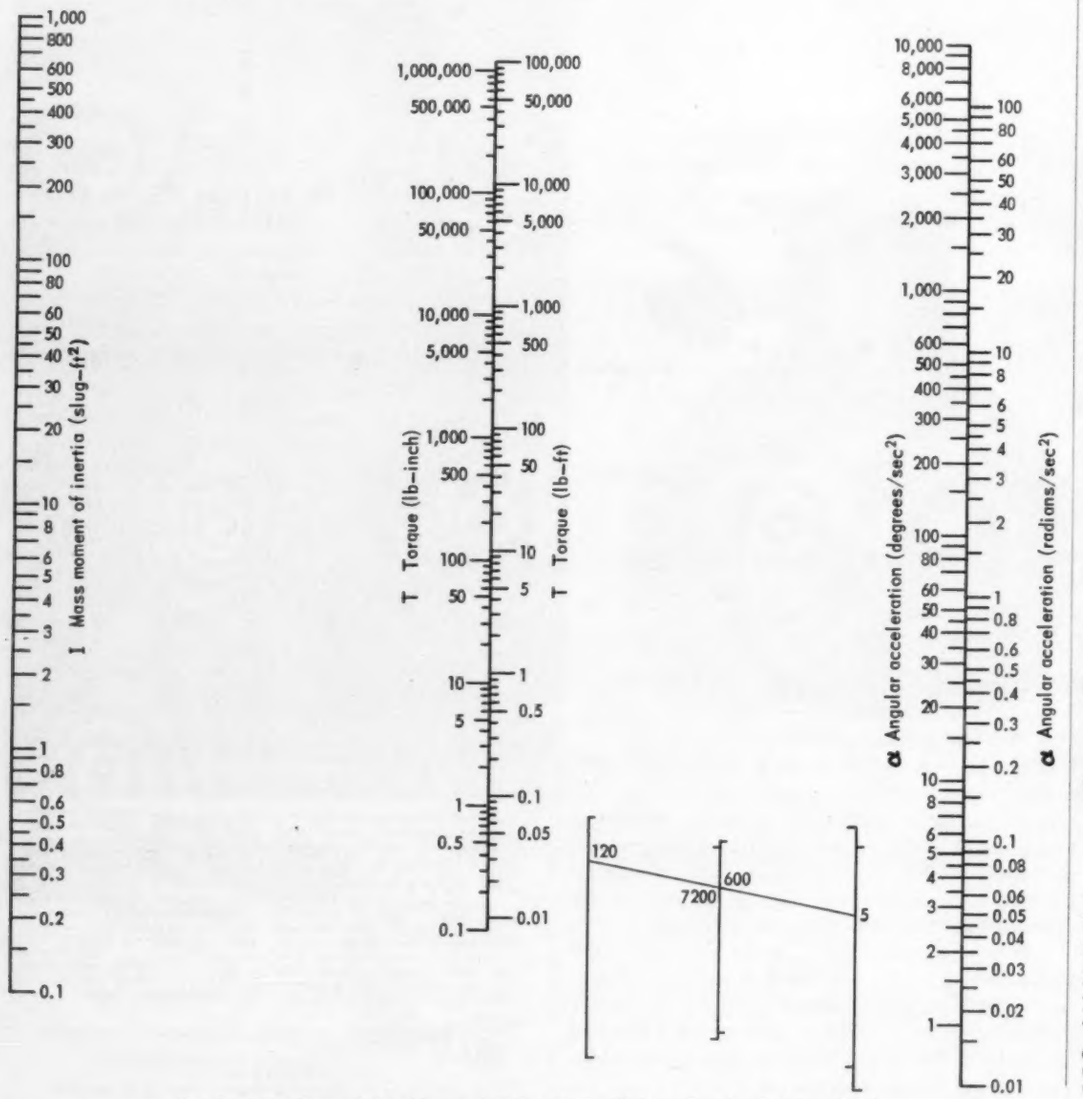
Richard Wadler, Mechanical Engineer, Raytheon Co., Bedford, Mass.

The nomogram represents the equation:

$$T = I\alpha$$

Where: T = torque, lb-ft
I = mass moment of inertia, slug-ft²
α = angular acceleration, radians/sec²

Example: Find the torque required to rotate a body which has a mass moment of inertia of 120 slug-ft² if the angular acceleration must be 5 radians/sec². Solution: Align I = 120 slug-ft² with α = 5 radians/sec² and read T = 600 lb-ft or 7200 lb-in.



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Laplace Transforms Simplified

S. Warren Kaye, West Peabody, Mass.

The modern theory of The Operational Calculus, a mathematical technique that has proven to be a powerful tool in solution of differential equations pertaining to various problems involving servo-mechanisms, dynamics (shock and vibration), electronics and so on, is based on the Laplacian Transformation. This transformation is usually written in the form:

$$F(p) = p\int_0^\infty f(x)\, e^{-px}dx$$

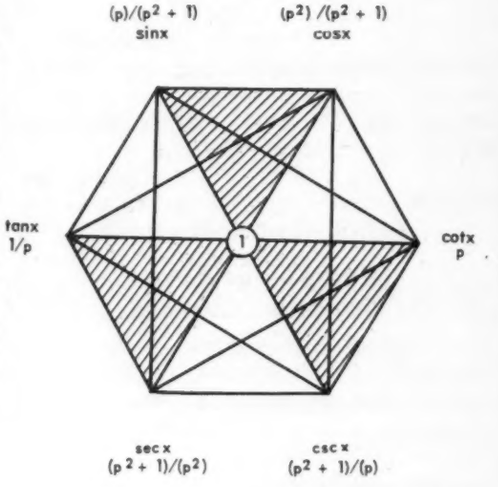
and is called the Laplace Transform of f (x). (Note: $p>0$.) The procedure is simple and similar to previous articles (November 15, 1957, page 140; July 7, 1958, page 86, and October 24, 1960, page 70) and will help solve complicated differential equations involving trigonometric, hyperbolic and exponential transforms.

Part I

Trigonometric Laplace Transforms

The basic transforms are:

$\sin x = (p)/(p^2+1)$
$\cos x = (p^2)/(p^2+1)$
$\tan x = 1/p$
$\csc x = (p^2+1)/(p)$
$\sec x = (p^2+1)/(p^2)$
$\cot x = p$



(Continued on next page)

Laplace Transforms . . . Cont.

Along Hexagon Sides Clockwise

$\tanx = \sinx/\cosx = (p/p^2+1)/(p^2/p^2+1) = 1/p$

$\sinx = \cosx/\cotx = (p^2/p^2+1)/(p) = (p)/(p^2+1)$

$\cosx = \cotx/\cscx = (p)/(p^2+1/p) = (p^2)/(p^2+1)$

$\cotx = \cscx/\secx = (p^2+1/p)/(p^2+1/p^2) = p$

$\cscx = \secx/\tanx = (p^2+1/p^2)/(1/p) = (p^2+1)/(p)$

$\secx = \tanx/\sinx = (1/p)/(p/p^2+1) = (p^2+1)/(p^2)$

Counterclockwise

$\cosx = \sinx/\tanx = (p/p^2+1)/(1/p) = (p^2)/(p^2+1)$

$\sinx = \tanx/\secx = (1/p)/(p^2+1/p^2) = (p)/(p^2+1)$

$\tanx = \secx/\cscx = (p^2+1/p^2)/(p^2+1/p) = 1/p$

$\secx = \cscx/\cotx = (p^2+1/p)/(p) = (p^2+1)/(p^2)$

$\cscx = \cotx/\cosx = (p)/(p^2/p^2+1) = (p^2+1)/(p)$

$\cotx = \cosx/\sinx = (p^2/p^2+1)/(p/p^2+1) = p$

Along Diagonals of Quadrilaterals Intersecting Hexagon Corners

$\tanx \cosx = \sinx = (1/p)(p^2/p^2+1) = (p)/(p^2+1)$

$\sinx \cotx = \cosx = (p/p^2+1)(p) = (p^2)/(p^2+1)$

$\cosx \cscx = \cotx = (p^2/p^2+1)(p^2+1/p) = p$

$\cotx \secx = \cscx = (p)(p^2+1/p^2) = (p^2+1)/(p)$

$\cscx \tanx = \secx = (p^2+1/p)(1/p) = (p^2+1)/(p^2)$

$\secx \sinx = \tanx = (p^2+1/p^2)(p/p^2+1) = 1/p$

Along Lines across Hexagon Corners

$\cscx = 1/\sinx = (1)/(p/p^2+1) = (p^2+1)/(p)$

$\secx = 1/\cosx = (1)/(p^2/p^2+1) = (p^2+1)/(p^2)$

$\cotx = 1/\tanx = (1)/(1/p) = p$

$\sinx \cscx = 1 = (p/p^2+1)(p^2+1/p) = 1$

$\cosx \secx = 1 = (p^2/p^2+1)(p^2+1/p^2) = 1$

$\tanx \cotx = 1 = (1/p)(p) = 1$

FOR EXAMPLE: Schrader Flow Control Valves—a unique combination of a poppet by-pass valve and a large "cone seat" metering valve provides full air flow in one direction and carefully controlled flow in the other. (A) Body of cast brass. (B) Compact plunger assembly replaceable in one unit. (C) "O" ring seal for surest airtight performance. (D) Extra-fine screw thread adjustment for vernier-like setting and sturdy lock-nut to hold adjustment even under rough treatment.

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Part II

Hyperbolic and Exponential Laplace Transforms

The basic transforms are:

$e^{-x} = (p)/(p+1)$ and $e^{x} = (p)/(p-1)$

where (see DESIGN NEWS, November 15, 1957, page 140):

$$\sinh x = (e^{x}-e^{-x})/2 = [(p)/(p-1)-(p)/(p+1)]/2 = [p(p+1)-p(p-1)]/2(p^2-1) = (p)/(p^2-1)$$

$$\cosh x = (e^{x}+e^{-x}) = [(p)/(p-1)+(p)/(p+1)]/2 = [p(p+1)+p(p-1)]/2(p^2-1) = (p^2)/(p^2-1)$$

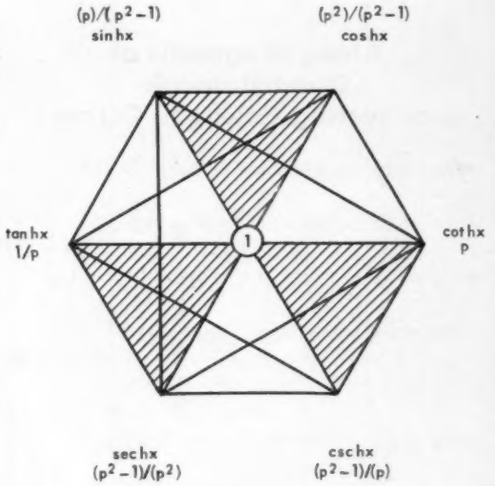
$$\tanh x = (e^{x}-e^{-x})/(e^{x}+e^{-x}) = [(p)/(p-1)-(p)/(p+1)]/[(p)/(p-1)+(p)/(p+1)] = 1/p$$

Similarly:

$\operatorname{csch} x = (p^2-1)/(p)$

$\operatorname{sech} x = (p^2-1)/(p^2)$

$\coth x = p$



Along Hexagon Sides Clockwise

$$\tanh x = \sinh x/\cosh x = (p/p^2-1)/(p^2/p^2-1) = 1/p$$

$$\sinh x = \cosh x/\coth x = (p^2/p^2-1)/(p) = (p)/(p^2-1)$$

$$\cosh x = \coth x/\operatorname{csch} x = (p)/(p^2-1/p) = (p^2)/(p^2-1)$$

(Continued on next page)

Laplace Transforms . . . *Cont.*

$$\cothx = \cschx/\sechx = (p^2-1/p)/(p^2-1/p^2) = p$$
$$\cschx = \sechx/\tanhx = (p^2-1/p^2)/(1/p) = (p^2-1)/(p)$$
$$\sechx = \tanhx/\sinhx = (1/p)/(p/p^2-1) = (p^2-1)/(p^2)$$

Counterclockwise

$$\coshx = \sinhx/\tanhx = (p/p^2-1)/(1/p) = (p^2)/(p^2-1)$$
$$\sinhx = \tanhx/\sechx = (1/p)/(p^2-1/p^2) = (p)/(p^2-1)$$
$$\tanhx = \sechx/\cschx = (p^2-1/p^2)/(p^2-1/p) = 1/p$$
$$\sechx = \cschx/\cothx = (p^2-1/p)/(p) = (p^2-1)/(p^2)$$
$$\cschx = \cothx/\coshx = (p)/(p^2/p^2-1) = (p^2-1)/(p)$$
$$\cothx = \coshx/\sinhx = (p^2/p^2-1)/(p/p^2-1) = p$$

Along Diagonals of Quadrilaterals Intersecting Hexagon Corners

$$\tanhx\ \coshx = \sinhx = (1/p)(p^2/p^2-1) = (p)/(p^2-1)$$
$$\sinhx\ \cothx = \coshx = (p/p^2-1)(p) = (p^2)/(p^2-1)$$
$$\coshx\ \cschx = \cothx = (p^2/p^2-1)(p^2-1/p) = p$$
$$\cothx\ \sechx = \cschx = (p)(p^2-1/p^2) = (p^2-1)/(p)$$
$$\cschx\ \tanhx = \sechx = (p^2-1/p)(1/p) = (p^2-1)/(p^2)$$
$$\sechx\ \sinhx = \tanhx = (p^2-1/p^2)(p/p^2-1) = 1/p$$

Along Lines across Opposite Hexagon Corners

$$\cschx = 1/\sinhx = (1)/(p/p^2-1) = (p^2-1)/(p)$$
$$\sechx = 1/\coshx = (1)/(p^2/p^2-1) = (p^2-1)/(p^2)$$
$$\cothx = 1/\tanhx = (1)/(1/p) = p$$
$$\sinhx\ \cschx = (p/p^2-1)(p^2-1/p) = 1$$
$$\coshx\ \sechx = (p^2/p^2-1)(p^2-1/p^2) = 1$$
$$\tanhx\ \cothx = (1/p)(p) = 1$$

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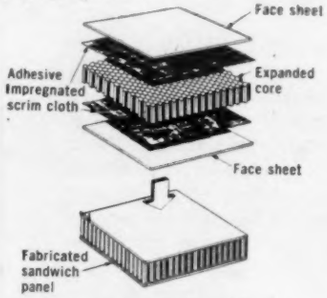
DESIGNERS' CHOICE: Materials for HONEYCOMB SANDWICH STRUCTURES

Honeycomb sandwich structures are composed of thin, high strength facings integrally bonded to light weight core material. The selection of materials to be used in such a structure is of primary importance in arriving at a satisfactory design providing optimum performance.

Figure 1 illustrates the three primary parts of this composite structure.



Facing Selection

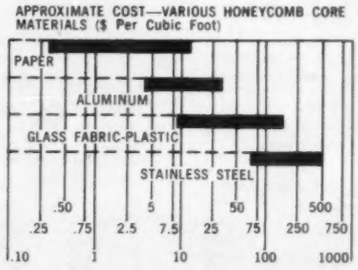
Generally the facings in a sandwich structure are selected in order to provide the highest compressive strength-to-weight ratio economically available in the size range under consideration. Examples of facings on successful sandwich applications are carbon steel in thicknesses of .030 to .050 for heavy duty flooring applications; aluminum alloy 7075 T6 in thicknesses of .010 to .093 for flooring and highly stressed panel applications, and porcelain enamel steel in 14 to 24 gauge for exterior curtain wall applications. Other special applications have dictated the use of high temperature reinforced fiber glass-plastic skins, stainless steel skins, cement asbestos board skins and similar materials. In every case, the facing selection must meet the multiple criteria of economy, structural efficiency, and process compatibility.

Adhesive Selection

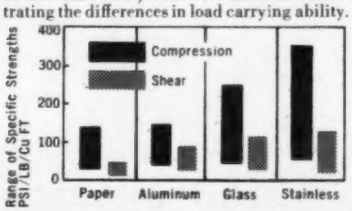
There are now available to designers a number of adhesive systems for attaching honeycomb core materials to high strength facings. Most high strength structural adhesives are based on various combinations of thermosetting resins which provide structural integrity throughout the environmental conditions encountered. For lightly loaded panels subject to less exacting environmental conditions there are a number of adhesives based on thermoplastic or elastomeric resins, some of which permit very economical sandwich fabrication.

Honeycomb Core Selection

Core materials are selected on the basis of structural performance, environmental requirements, and economy.



It can be seen that the cost of honeycomb core materials varies considerably. It should not be inferred, however, that the performance of a particular core is measured by its cost. Figure 3 indicates the specific strength of the same honeycomb core materials illustrating the differences in load carrying ability.



With proper selection of facing, adhesives and honeycomb core, the designer can achieve optimum structural performance with minimum weight. For example, a beam of steel plate weighing 68.6 lbs. can be replaced by a structural honeycomb sandwich beam of 7.8 lbs. with the same deflection and strength.

The design opportunities for honeycomb sandwich structures are apparent.

Since World War II designers of air and space craft have made ever-increasing use of honeycomb in a great variety of structural and non-structural applications. Honeycomb can be made from almost any material available in continuous web or roll form, e.g., aluminum, glass fabric, cotton, stainless steel, paper, asbestos, titanium. In its cellular configuration, honeycomb is 97% air, 3% material.

Honeycomb has intrinsic qualities of high strength, light weight, high ratio of surface area to volume and other specific properties which depend upon the type of material used. These combinations of properties, which have given honeycomb wide application in air and space craft, offer to designers in industry generally unique opportunities in product design. In the interest of advancing this knowledge of honeycomb, Hexcel, through its research and development staff (the industry's largest), has prepared this informational series. Should you desire additional technical information or copies of others in this series, please complete the information request form on this page. Your request will receive immediate attention.

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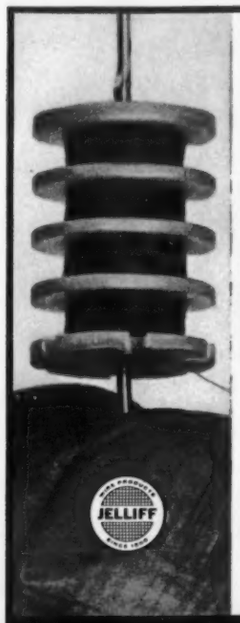

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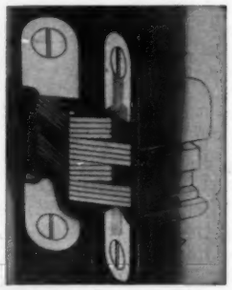

These hinges are completely hidden from view when door, lid or hood is closed. Makes possible flush, absolutely smooth surfaces that greatly enhance appearance and safety. Tapered body sections are precision castings of a special zinc base alloy having a tensile strength of 47,000 pounds per square inch. Operates in a 180 degree arc which permits full opening. Laminated link construction reduces friction and permits hinges to operate freely and smoothly. Hinges are reversible and may be used right or left hand. Available for wood or metal application in a wide variety of sizes.

SOSS MANUFACTURING COMPANY, Dept. DN-32, P. O. Box 38, Harper Station, Detroit 13, Michigan.

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Wind Force against Rectangular Surfaces

Richard Wadler, Mechanical Engineer, Raytheon Co., Bedford, Mass.

The nomogram is based on the equation

$$F = ACP$$

Where

$$P = \rho V^2/2$$

and

F = wind force, lb
A = surface area, sq ft
C = shape factor (see Table I)
P = wind pressure, psf
ρ = mass density of air = 0.00238 slug/cu ft
V = wind velocity, fps

Example:

If a flat rectangular surface (a = 5 ft, b = 1.5 ft) is exposed to a wind velocity of 50 mph, what is the acting wind force?

Solution:

$$b/a = 1.5/5 = 0.3$$

From Table I, C = 1.18

$$A = (5)(1.5) = 7.5 \text{ sq ft}$$

Align C = 1.18 with A = 7.5, intersecting reference line. Align this intersection with V = 50 and read F = 57 lb.

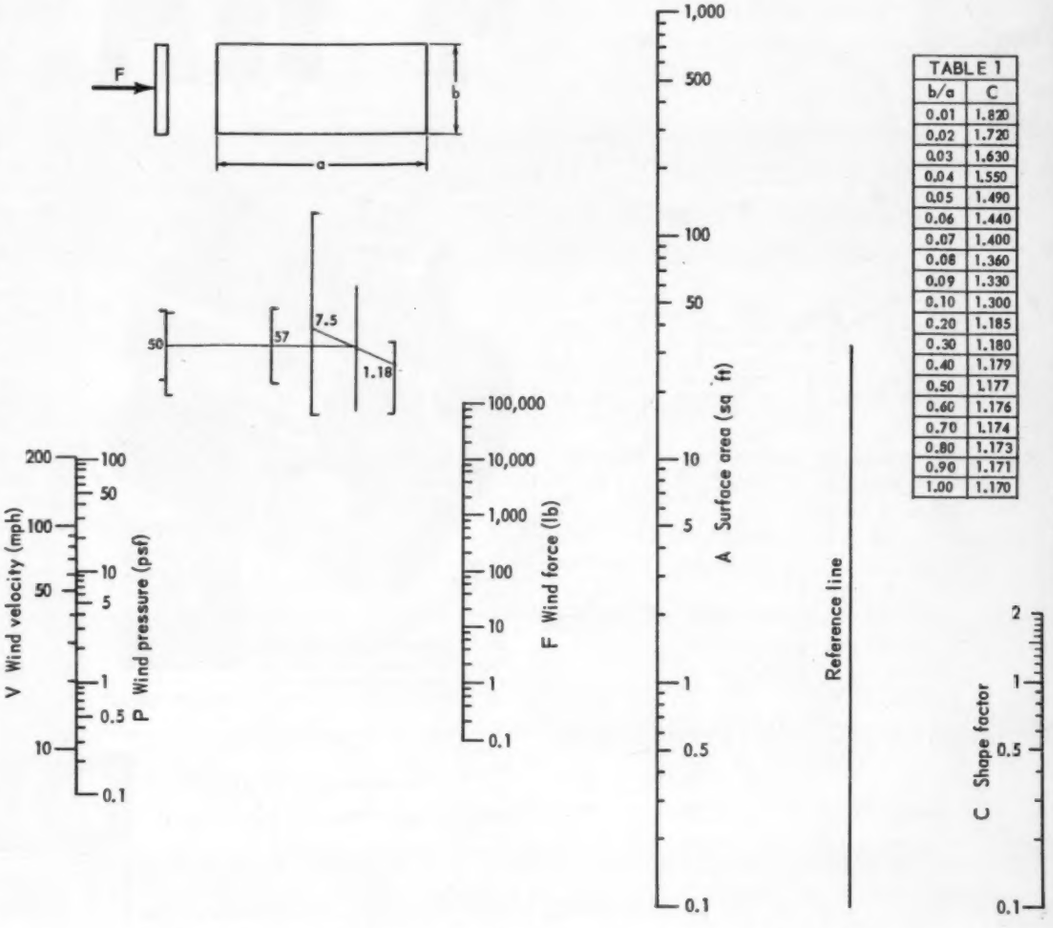

TABLE I

b/a	C
0.01	1.820
0.02	1.720
0.03	1.630
0.04	1.550
0.05	1.490
0.06	1.440
0.07	1.400
0.08	1.360
0.09	1.330
0.10	1.300
0.20	1.185
0.30	1.180
0.40	1.179
0.50	1.177
0.60	1.176
0.70	1.174
0.80	1.173
0.90	1.171
1.00	1.170

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Surface Area of an Ellipsoid

B. Saelman, Lockheed Aircraft Corp., Burbank, Calif.

The surface area of an ellipsoid cannot be expressed in terms of elementary functions. As in the case of the rectification of an ellipse, elliptic integrals must be employed in evaluating the

surface area. The ellipsoid is defined by the equation:

$$x^2/a^2 + y^2/b^2 + z^2/c^2 = 1 \qquad (1)$$

where a, b and c are the lengths of the semi-axes of the ellipsoid, and

$$a^2 > b^2 > c^2$$

The surface area of the ellipsoid is given by

$$S = 2\pi c^2 + \frac{2\pi b}{\sqrt{a^2 - c^2}} [(a^2 - c^2) E(\theta) + c^2\theta] \qquad (2)$$

where θ and $E(\theta)$ are found from Fig. 1 and 2. The following auxiliary equations are required in evaluating Eq. 2:

$$e_1^2 = (a^2 - c^2)/a^2 = sn^2(\theta, k) = \sin^2\phi \qquad (3)$$

$$e_2^2 = (b^2 - c^2)/b^2 \qquad (4)$$

$$k^2 = (e_2^2)/(e_1^2) = \sin^2\beta \qquad (5)$$

$$\theta = F(k, \phi) = \int_0^{\phi} \frac{d\phi}{\sqrt{1 - k^2\sin^2\phi}}, \text{(Fig. 1)} \qquad (6)$$

$$E(\theta) = E(k, \phi) = \int_0^{\phi} \sqrt{1 - k^2\sin^2\phi}\, d\phi, \text{(Fig. 2)} \qquad (7)$$

Example: Evaluate the surface area of the ellipsoid with semi-axes of lengths a = 2.58, b = 2.39 and c = 2.00.

Solution: By Eq. 3: $e_1^2 = \sin^2\phi = 0.4$,

$\phi = 39$ deg 17 minutes

Eq. 4: $e_2^2 = 0.3$

Eq. 5: $k^2 = \sin^2\beta = 0.75$, $\beta = 60$ deg

From Fig. 1: $\theta = 0.75$

From Fig. 2: $E(\theta) = 0.65$

Then by Eq. 2:

$$S = 2\pi(2)^2 + \frac{2\pi\ (2.39)}{\sqrt{2.58^2 - 2^2}} [(2.58^2 - 2^2)\ (0.65) + 2^2\ (0.75)] = 68.7$$

As a special case, when c = 0, then $e_1 = 1.0$, $e_2 = 1.0$, k = 1.0 and the surface area of the ellipsoid as given by Eq. 2 reduces to twice the area of an ellipse. In this case $\beta = \pi/2$, $\phi = \pi/2$ and Eq. 2 becomes: $S = 2\pi$ (a) (b)

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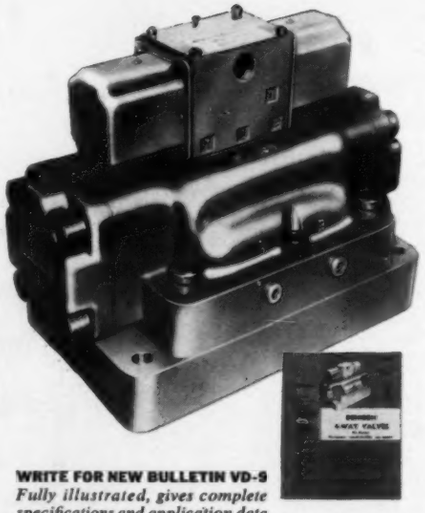

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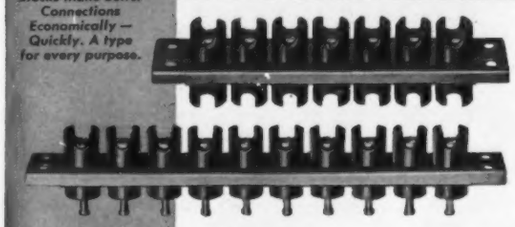

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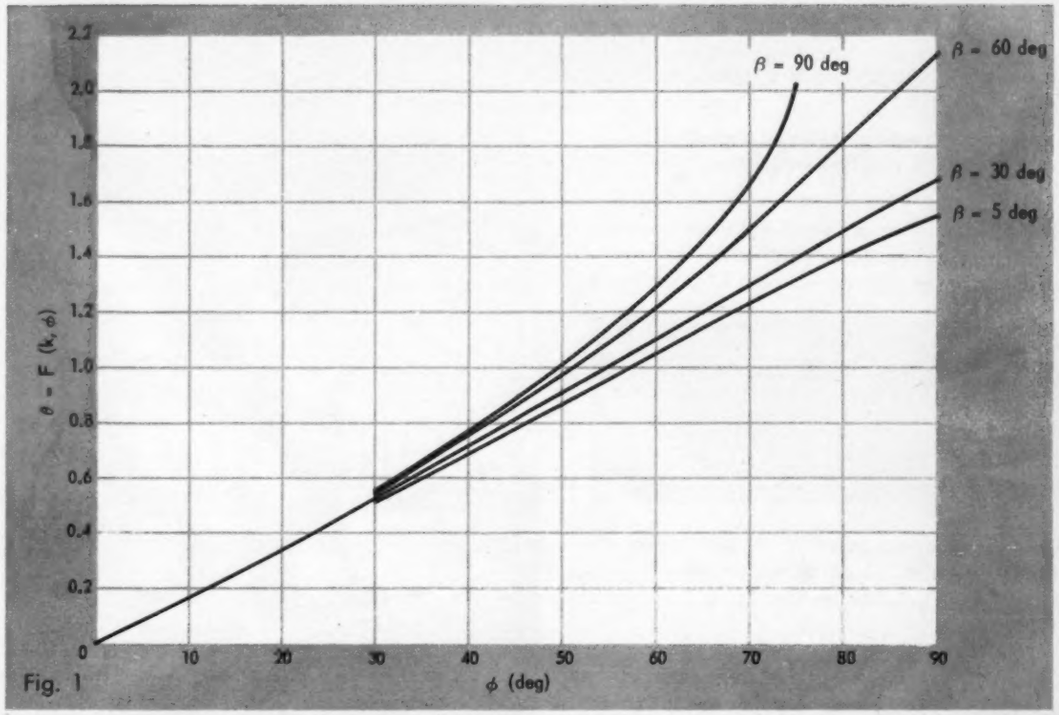

Fig. 1

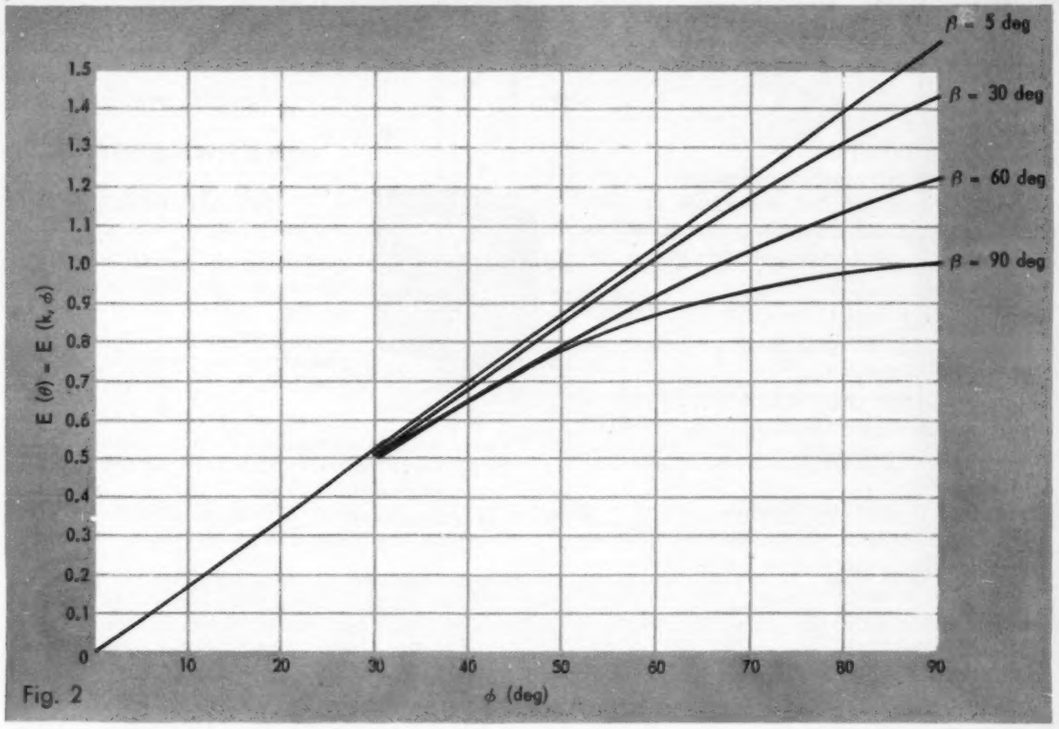

Fig. 2

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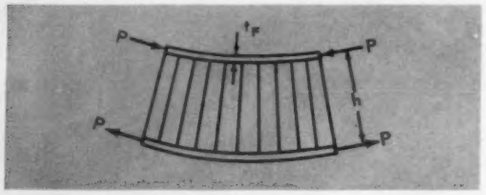
Flexural Strength Of Sandwich Panel

C. E. Feddersen, Analytical Engineer,
Avco Corp., Nashville, Tenn.

The accompanying chart will aid in determining the flexural strength of a sandwich beam or panel. Because the flexural strength of a sandwich



structure is concentrated in its face sheets, the bending moment M can be expressed as:

$$M = Ph$$

Where:

P = face sheet load

h = distance between face sheet centroids

The load P is the same in upper and lower face sheets and their stress levels are dependent only on their respective thicknesses. Considering a unit width:

$$S = P/t_F$$

But: $P = M/h$

$\therefore \quad S = M/(h)(t_F)$

or $M = (S)(h)(t_F)$, for a unit width.

Assuming that both face sheets have the same allowable stress, the allowable moment will be determined by the thickness of the thinnest face sheet.

Example 1: If $h = 1.15$ inches, $t_F = 0.070$ inch and $S_B = 40{,}000$ psi, determine allowable bending moment.

Solution: Entering chart at $h = 1.15$, project to $t_F = 0.070$, thence vertically to $S_B = 40{,}000$, thence horizontally and read $M_a = 3250$ lb-in/inch.

Example 2: If allowable bending moment is to be 2000 lb-in/inch, determine face thickness if material allowable stress = 30,000 psi and h is not to exceed 1.0 inch.

Solution: Entering at $M_a = 2000$, project to $S_B = 30{,}000$, thence vertically to intersection with horizontal projection from $h = 1.0$, and read $t_F = 0.067$ inch. Use 0.067 inch or next higher available gage.

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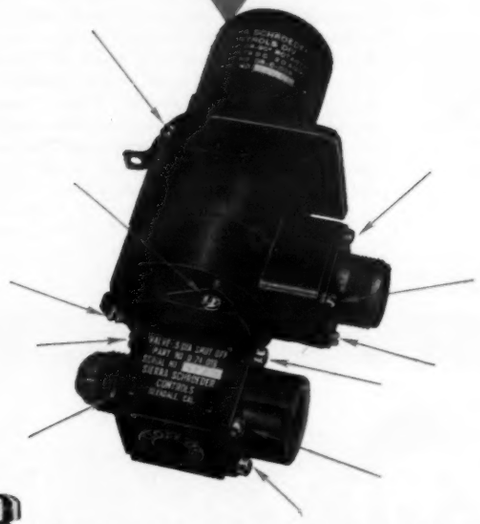

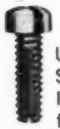

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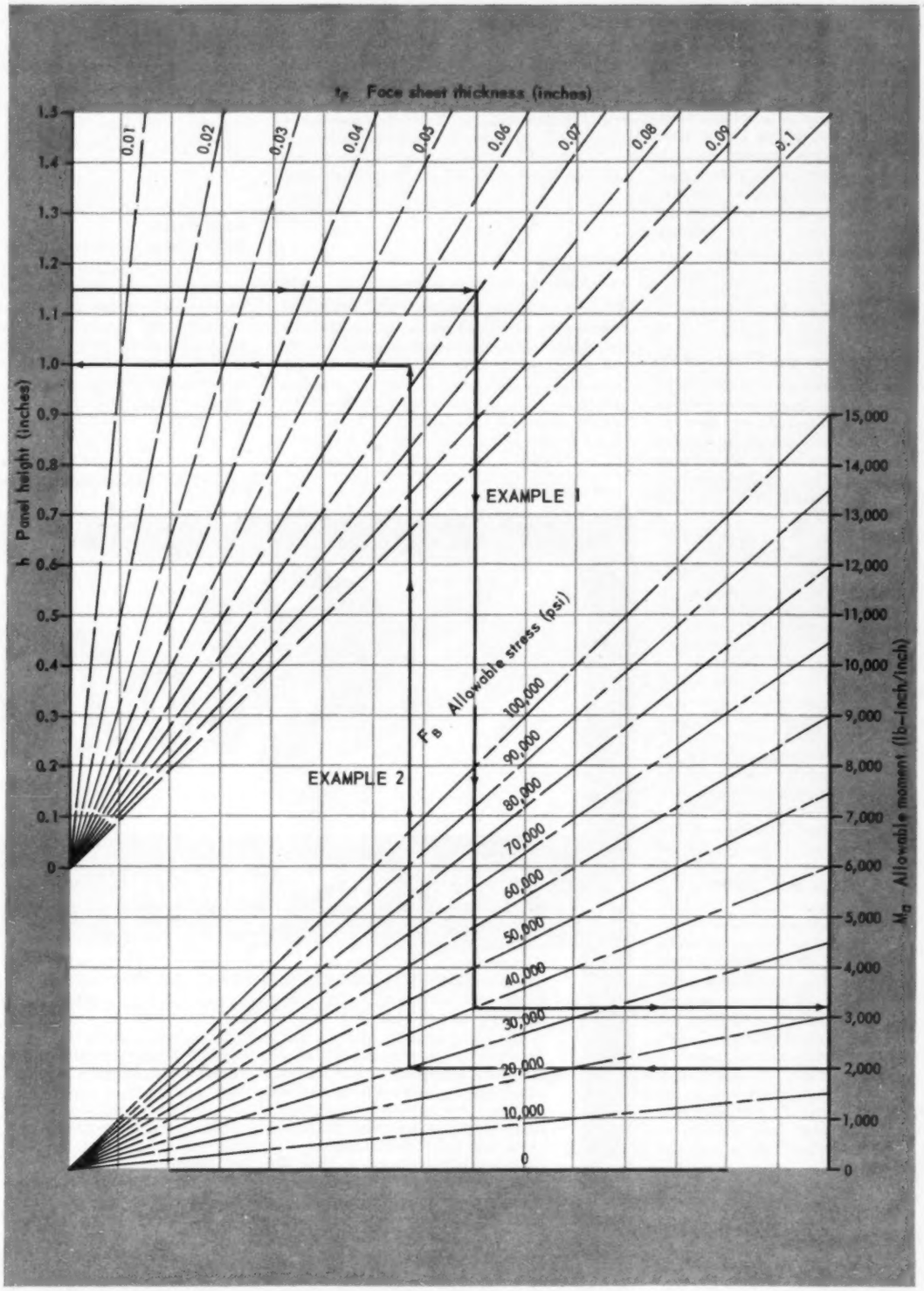

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NEW LITERATURE

Fastener Engineering Data 451

Engineering prints on fasteners for effective elevated-temperature use (bolts, screws, nuts, dowels and miniature internal wrenching bolts). Revised Engineering Data Catalog No. 286 gives general characteristics, physical properties and typical applications for the elevated-temperature fasteners. Mercury Air Parts Co;, Inc., 9310 W. Jefferson Blvd., Culver City, Calif.

Approximate Static-Pressure Chart 452

Intended as a guide to industry in determining approximate pressures required, in pounds per character, to mark correctly various types of metals, Chart No. 361 resulted from a series of tests made to determine the approximate static pressures required to produce an indented mark, in a specific range of sizes and depths, on brass, aluminum, machine steel and tool steel. Steel Marking Tool Institute, 912 Chicago Ave., Evanston, Ill.

Electronic Transformers 453

Features and advantages of a full line of electronic transformers for military applications. Bulletin GEA-7121, 28 pages, contains sections on stock models of metal-cased, hermetically sealed transformers and inductors, sipermil (encapsulated), and subminiature and microminiature transformers. Reliability and military specifications are discussed, and information is provided on how specifications affect transformer design and the effect of design parameters on construction. Charts show model numbers, ratings and case dimensions, and a table and diagrams cover characteristics of common rectifier circuits. General Electric Co., Schenectady 5, N.Y.

Printed Circuits 454

"Depth in Circuitry" contains complete specifications for all types of printed circuits available from the manufacturer. Descriptions are given of flexible, flush and multilayer circuits and the "Carte Blanche" series of standardized plated-circuit cards. Design and production capabilities are included. U. S. Engineering Co., Div. of Litton Industries, 13536 Saticoy St., Van Nuys, Calif.

Wirewound Termination Characteristics 455

An engineering fact sheet deals with termination problems in wirewound potentiometers and describes some of the common termination methods and the "Silverweld" termination process. Some of the advantages of this termination technique and its applications are included. Bourns, Inc., 6135 Magnolia Ave., Riverside, Calif.

Electronic Wire and Cable 456

File No. 128, 48 pages, catalogs 6000 wire and cable products. Some of the new products included are heat-shrinkable tubing, retractile communication and power cords, "Teflon" cables, replacement cord sets, zipper tubing and "Teflon" magnet wire. A descriptive index, a numerical index and a government-and-industrial specification index facilitate finding items of interest. An "E-Z" identification chart is provided to help locate the right wire for specific requirements. Alpha Wire Corp., 200 Varick St., New York 14, N. Y.

Basic Guide To Electrical Contacts 457

Includes charts covering applications and technical data for various contact alloys and specifications of the most commonly used stock contacts. Sections of the eight-page guide cover points to be considered in the design, specification and purchase of rivet contacts, laminated contacts, spring and blade components, and complete assemblies. Tricon Mfg. Co., 8010 S. Wallace, Chicago 20, Ill.

Urethane Foam Fact File 458

Urethane foam's excellent packaging properties are examined in a 20-page "Fact File for the Industrial and Commercial Packager". Molding in place and contouring advantages are discussed in addition to vibration damping, lightness, low cost, aging, resistance to chemicals, dampness and wire-temperature fluctuations as they relate to packaging. Mobay Chemical Co., Pittsburgh 5, Pa.

Aluminum Electrical Conductors 459

Revised edition "Aluminum Electrical Conductors, Stranded-Bare" contains data on conductors, core wires, cable reels and conductor lengths. Separate physical characteristics and packaging tables for ACSR (Aluminum Conductor, Steel Reinforced) and stranded aluminum conductors are presented, as well as conductor cross-section diagrams and reel and coil data. The 24-page publication includes 5005 aluminum alloy conductors, aluminized steel core wire for ACSR and details on a new size of expanded ACSR. Rome Cable Div., Aluminum Co. of America, Rome, N. Y.

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Tap, Die and Gage Standards 460

Government "National Microminiature" standards for taps, dies and gages are described in a 10-page brochure. The new "OOC" series of precision taps, dies and gages conforming to these standards is available in kits and refills in production quantities. Pitch-diameter specification tables for plug and ring gages, and a tap-drill diameter table for different depths of engagement are provided. R. P. Gallien & Son, 220 W. Fifth St., Los Angeles 13, Calif.

Silicone Paper Coatings 461

Describes how "Syl-off" silicone coatings impart nonsticking or release characteristics to a variety of package liners, processing papers, interleaving and slip sheets. Brochure 8-605 gives typical applications for the coated papers including use on raw rubber, asphalt, adhesives and plastic bases. Pressure-sensitive decals, labels, wallpaper peel free from "Syl-off" coated separators or backing papers without tearing. Samples of the coated paper are included in the fold-out form. Dow Corning Corp., Midland, Mich.

High-Strength Fasteners 462

A 16-page study consists of data on 10 actual aerospace bolt failures, either in flight, on the test stand or in preliminary quality-control testing. Shortcomings in fastener procurement are pointed out in Emergency Report No. 495 and each case shows a generalized description of the applications, details of the failure and reasons why. Photos show type of bolting and metallurgical nature of failure. Standard Pressed Steel Co., Jenkintown, Pa.

Molded Metal Film Precision Resistors 463

Catalog No. 50 describes "Metohm" resistors—features, applications, ratings, dimensions, temperature coefficients, design features, specifications and characteristics are given. The four-page folder includes a load-versus-temperature-rise chart and a derating curve for types WL60, 65 and 70. Both the four-page catalog and accompanying price list are punched for binding. Ward Leonard Electric Co., 115 S. MacQuesten Pkwy., Mount Vernon, N.Y.

To obtain copies of numbered literature . . . circle appropriate number on Reader-Service card.

Precision Wire Wound Resistors 464

Technical data, performance curves and photographs on "Davohm" and "Super Davohm" precision resistors: miniature, subminiature, axial-lead, lug, printed-circuit, high-frequency card-type, ceramic and hermetically sealed types. The 20-page catalog includes a discussion of a high-reliability resistor program. The Daven Co., 538 W. Mt. Pleasant Ave., Livingston, N.J.

Filtration Data 465

A bibliography of articles on filtration, filter media, dust collecting, air-pollution control, air conditioning, sifting, sieving and straining. This 16-page reference manual lists the subjects of many articles, publications in which they appeared, dates of issue, page numbers and synopses of the contents. Snow Filtration Co., 129 W. 4th St., Cincinnati 2, Ohio.

Vinyl-Aluminum Laminate 466

A sample of a new vinyl-aluminum laminate, "Alcoa Vynalate", and chips of each of 39 special vinyl color-pattern combinations are included in a 20-page spiral-bound brochure, "Design with 'Alcoa Vynalate' " suggests uses to industrial designers and design engineers for this material and provides technical data which, accompanied by the samples, demonstrate seven families of special vinyl designs in from four to eight colors per design. Aluminum Co. of America, 720 Alcoa Building, Pittsburgh 19, Pa.

Film Design File 467

Detailed information on available types of "Scotchcal" film in a reference folder. Samples of actual emblems, insignia and nameplates are included in addition to samples of the 630 (chrome, gold and transparent), the 3650 (white, red, yellow, black, aluminum and insignia blue), the 3460 (display film) and the 3480 (yellow-orange and red-orange fluorescent) series. Applications, design possibilities, adhesion qualities and physical properties are given for the films. Minnesota Mining and Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.

Stereo and Mono High-Fidelity Equipment 468

This 28-page catalog covers a complete line of stereo and mono high-fidelity equipment, test instruments, ham gear, citizens radios and transistor radios available in both kit and wired form. Featured is the new Medalist series of stereo high-fidelity equipment (consisting of transistorized stereo/mono tape deck RP-100, stereo AM/FM tuner ST-96 and two integrated stereo amplifiers), test instruments and a citizens band transceiver. Illustrations, specifications and prices are given for more than 80 items. Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N.Y.

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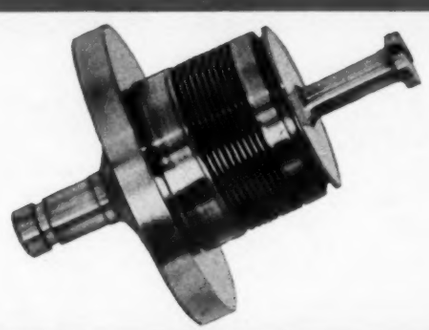

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LITERATURE

Optical and Test Instruments 469

Illustrations and descriptions of a line of optical and physical test instruments. The 28-page bulletin includes abrasion testers, colorimeters, color-difference meters, scratch thickness gages, wet-film thickness gages, portable glossmeters, impact testers, multipurpose reflectometers, precision reflectometers, photometric stands, precision transmittometers, tensile strength and elongation apparatus, and accessory equipment for many of the featured units. Prices are listed for all items. Gardner Laboratory, Inc., Box 5728, Bethesda 14, Md.

Panel Instruments 470

A standardized line of panel instruments in a choice of sizes, case styles, accuracies, pointers, scales and ranges. The 1900 series is composed of a-c and d-c ammeters, milliammeters, microammeters and voltmeters. Features of the units are included, such as springback jewels with locking nuts for fine adjustment, interchangeability of clear plastic or "Bakelite" covers, and common base and shell for various mechanism types. Fold-out Bulletin No. 01-113 illustrates the new method of construction of these panel instruments. Daystrom, Inc., Weston Instruments Div., 614 Frelinghuysen Ave., Newark, N.J.

Pilot Lights Digest 471

Offers condensed technical data on a wide range of pilot lights and the lamps for which they were designed. Categories described in Form L-161C include subminiature indicator lights, pilot lights with builtin resistors for neon lamps, enclosed assemblies for neon and incandescent lamps, oil-tight indicator lights, dimmers, light shields, press-to-test indicator lights, lens holders for panel mounting, connectors and sockets for small lamps. The 24-page digest provides life-sized illustrations of the units, catalog numbers, physical and electrical characteristics and specification charts. Dialight Corp., 60 Stewart Ave., Brooklyn 37, N. Y.

Photographic Papers and Films 472

Describes engineering and other industrial photographic papers and films and projection materials for engineering, offset printing, microfilm and related uses. The 24-page booklet includes direct positive papers and films, monobath (multiple-copy photocopying) papers and processing solutions, 27-, 12- and 9-inch diffusion transfer processors, and various darkroom and processing machine developers, fixers and other solutions. A section, entitled "Darkroom Tips", covers the handling of engineering drawing reproductions and intermediates, as well as a comparison chart containing more than 30 contact and projection papers and films available. Anken Chemical & Film Corp., Newton, N.J.

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Variable-Speed Sheaves 473

Bulletin 25103 describes two types of motion-control variable-speed sheaves. "MS" sheaves rated from 2 to 15 hp and "MCS" sheaves rated from 7.5 to 20 hp are illustrated, and tables of specifications are provided for models in both series. The 16-page brochure also covers "Sure-Grip" companion pulleys and sheaves, variable-speed belts, motion-control motor bases and "Quick-Slide" motor bases. T. B. Wood's Sons Co., Chambersburg, Pa.

Structural Design Manual 474

The story of "Lindsay Structures". Several sections of the 60-page manual show diversity of use, complete listing and description of all parts and components, the variety of materials in which Lindsay Structure is available, a thorough explanation of special applications and a discussion of the technical aspects of the structure with test data in text, graph and tabular forms. International Steel Co., Lindsay Structure Div., 1321 Edgar St., Evansville 7, Ind.

Molded and Extruded Vinyl and Rubber 475

Reviews developments in transfer molding, transfer splicing and extruding products of interest to the automotive, appliance and construction industries. Form G-61, 16 pages, features a variety of one-piece dual durometer transfer molded parts and shows parts produced by a new dual-compound extrusion process. Development of semirigid vinyl extruded trim and rubber extruded over rigid metal for electrical insulation is discussed and unusual extruded cross-sections of vinyl and special rubber shapes are included. Geauga Industries Co., Middlefield, Ohio.

Socket-Head Cap Screws 476

Specification and performance data for the "Unbrako" KS 812 series of stainless-steel socket-head cap screws. The series is rated at 125,000 psi minimum tensile strength at room temperature and for a wide temperature range of application. A table of mechanical properties gives tensile, yield and shear strength, fatigue endurance and stress relaxation values for temperatures ranging from −60 to 800F. Dimensional information in the four-page Form 2734 covers standard diameter sizes No. 8 through 3/8 inch. Standard Pressed Steel Co., Jenkintown, Pa.

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DIMENSIONS FOR CROWN-TYPE HRH GEARS

For a gear outside diameter of unity and 90° shaft angle.

Ratio	R_a	10⅓	12⅓	14⅓	17⅓	21⅓	25⅓	31⅓	38	47	58	71	87	106
Number of Pinion Teeth	n	4	4	3	3	2	2	2	1	1	1	1	1	1
Number of Gear Teeth	N	41	49	44	52	43	51	63	38	47	58	71	87	106
Offset	E	0.20000	0.20000	0.25000	0.25000	0.30000	0.30000	0.33333	0.33333	0.33333	0.33333	0.33333	0.33333	0.33333
Whole Depth	ht	0.03595	0.02859	0.03547	0.02880	0.03888	0.03200	0.02738	0.04480	0.03556	0.02827	0.02293	0.01849	0.01511
Gear Outside Diameter	D_{go}	1.00000												
Gear Crown Distance	X_c	0.08800	0.08299	0.07920	0.07800	0.06928	0.06832	0.06809	0.06027	0.06080	0.06720	0.06969	0.07004	0.07182
Gear Face Width	F	0.13003	0.13003	0.13000	0.13000	0.13008	0.13008	0.12996	0.12996	0.12996	0.12996	0.12996	0.11502	0.09440
Pinion Outside Diameter	D_{po}	0.23968	0.21621	0.22107	0.20667	0.20688	0.19296	0.18400	0.19929	0.18400	0.18400	0.17938	0.17244	0.16996
Pinion Inner Crown Distance	B_i	0.29429	0.29792	0.25413	0.25613	0.19344	0.19648	0.13849	0.13849	0.13849	0.13849	0.13849	0.17031	0.20924
Pinion Outer Crown Distance	B_o	0.48672	0.48363	0.47067	0.46707	0.44944	0.44480	0.42222	0.43289	0.42667	0.42276	0.41867	0.41422	0.41102
Minimum Pinion Mounting Distance	B_M	0.52597	0.51392	0.50013	0.49040	0.47360	0.46448	0.43644	0.45511	0.44391	0.43644	0.42951	0.42347	0.41884
Gear Spiral Angle (Deg.)	Ψ	41.45	45.00	37.69	40.83	32.03	34.55	29.42	30.56	32.49	34.00	35.16	37.39	39.71
Pinion Spiral Angle (Deg.)	Ψ_p	68.82	72.37	72.77	75.91	75.63	78.15	79.44	80.58	82.51	84.02	85.18	86.26	87.11
Pressure Angles Degrees	Φ_1	10												
	Φ_2	30												

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The Fourth Dimension in Design

J. A. Gilligan, Structures Engineer, United States Steel Corp., Pittsburgh, Pa.

Design is concerned with the arrangement and proportioning of structural components made of constructional materials to produce efficient, safe and economical structures. Thus, design is concerned with both geometrical and material considerations.

Geometrical considerations involve the three dimensions of space. But these dimensions are intimately related to, and dependent on the types and grades of constructional materials used. In the past, the designer was limited to a very few types of constructional materials and, consequently, design was essentially one of geometrical considerations. Today, however, research has developed a multiplicity of grades of new and different types of materials. The designer must concern himself not only with the geometrical considerations, but also with that "fourth dimension", which is the selection of the most satisfactory and economical type and grade of material to perform the required function.

The Family Of Constructional Steels

With the increased number of steels that are available today, the scope of the "fourth dimension" in designing with steel is almost unlimited.

The family of constructional steels comprises three different types of steels, ranging in yield point or yield strength from 32,000 to 100,000 psi: (1) structural carbon steels, (2) high-strength steels and (3) heat-treated constructional alloy steels. The American Society for Testing Materials (ASTM) designations and United States Steel brand names for these steels, together with their minimum specified strength requirements, weldability and average net mill price, in effect April 27, 1961, are shown in Tables 1, 2 and 3.

The Fourth Dimension Applied in Design

The following are examples of how this "fourth dimension" can be and is being applied in the design of steel structures.

1. **Cylindrical Storage Tanks**

Consider a cylindrical storage tank made of several courses of steel plates such as those used in the petroleum industry, as indicated in Fig. 1. When filled with a liquid, the pressures on the wall of such a tank vary from zero near the top to a maximum at

TABLE 1. STRUCTURAL CARBON STEEL

Steel (ASTM Designation or Trade Name)	Section Thickness (Inches)	Specified Minimum Strengths: Tensile Strength (psi)	Specified Minimum Strengths: Yield Point (psi)	Average Net Mill Price (cents per lb.)	Suitable for Welding
A7 Steel for Bridges and Buildings	All	60,000	33,000	6.4	NO[1]
A373 Structural Steel for Welding	To 4, Incl.	58,000	32,000	6.6	YES
A36 Structural Steel	To 4, Incl.	60,000	36,000	6.5	YES

[1]To one inch inclusive, YES. Over one inch, varies for different specifications.

TABLE 2. HIGH-STRENGTH AND HIGH-STRENGTH, LOW-ALLOY STEELS

ASTM Designation	USS Brand Name	Section Thickness, (Inches)	Specified Minimum Strengths: Tensile Strength (psi)	Specified Minimum Strengths: Yield Strength (psi)	Average Net Mill Price (cents per lb.)	Suitability for Welding
A242 High-Strength Low-Alloy Steel	COR-TEN[1]	To ¾, Incl.	70,000	50,000	8.7[2]	YES
		Over ¾ to 1½, Incl.	67,000	46,000		
		Over 1½ to 4, Incl.	63,000	42,000		
A440 High-Strength Structural Steel	MAN-TEN (A440)	To ¾, Incl.	70,000	50,000	7.4	NO
		Over ¾ to 1½, Incl.	67,000	46,000		
		Over 1½ to 4, Incl.	63,000	42,000		
A441 High-Strength Low-Alloy Manganese-Vanadium Steel	TRI-TEN	To ¾, Incl.	70,000	50,000	8.4	YES
		Over ¾ to 1½, Incl.	67,000	46,000		
		Over 1½ to 4, Incl.	63,000	42,000		

[1]USS Cor-Ten Steel meets ASTM specification A-242 to ½" inclusive; over 1 to 1½" inclusive; over 2¼" to 3" inclusive.
[2]Cor-Ten price.

TABLE 3. HEAT-TREATED CONSTRUCTIONAL ALLOY STEEL

ASTM Designation	USS Brand Name	Section Thickness, (Inches)	Specified Minimum Strengths: Tensile Strength (psi)	Specified Minimum Strengths: Yield Strength (psi)	Average Net Mill Price (cents per lb.)	Suitability for Welding
NONE	"T-1"	To 2½" incl.	115,000	100,000	15.5	YES
		Over 2½ to 6, incl.	105,000	90,000	15.5	
	"T-1" Type A	To 1", incl.	115,000	100,000	13.2	YES

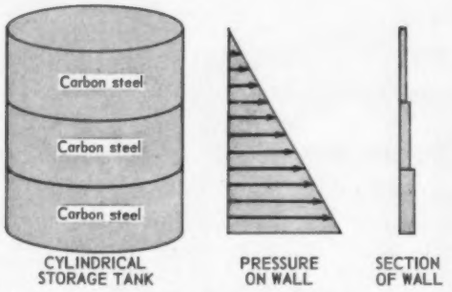

Fig. 1 STORAGE TANK MADE OF ONE GRADE OF STEEL

the bottom as indicated. In the past, plate thicknesses for the walls of tanks have varied in steps from a minimum near the top to a maximum at the bottom, as indicated in the figure. By utilizing the "fourth dimension" concept, that is, by utilizing the family of constructional steels which are now available, it is possible to use structural carbon-steel plates for the top courses of the vessel where pressures are low, a high-strength low-alloy, 50,000-psi yield-point steel in the plates for the intermediate courses and a 100,000-psi yield-strength heat-treated constructional alloy steel in the plates for the lower courses of the tank where the pressure is greatest. In so doing, it is possible to design a tank having a uniform wall thickness for the full height of the tank, as indicated in Fig. 2.

2. **Hybrid Steel Beam Construction**

In the design of beams or girders, it is normally assumed that the flanges and the web (s) are made of similar strength material. As such, material near the neutral axis is understressed. Exceptions to this are in girders where different strength steels may be applied to correspond to the stress gradient in the beam.

A somewhat different approach to the design of beams is now gaining acceptance. This

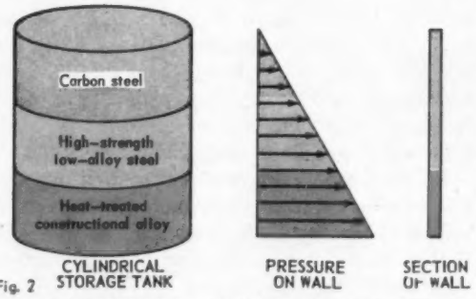

Fig. 2 FOURTH DIMENSION APPLI ED IN DESIGN OF STORAGE TANK

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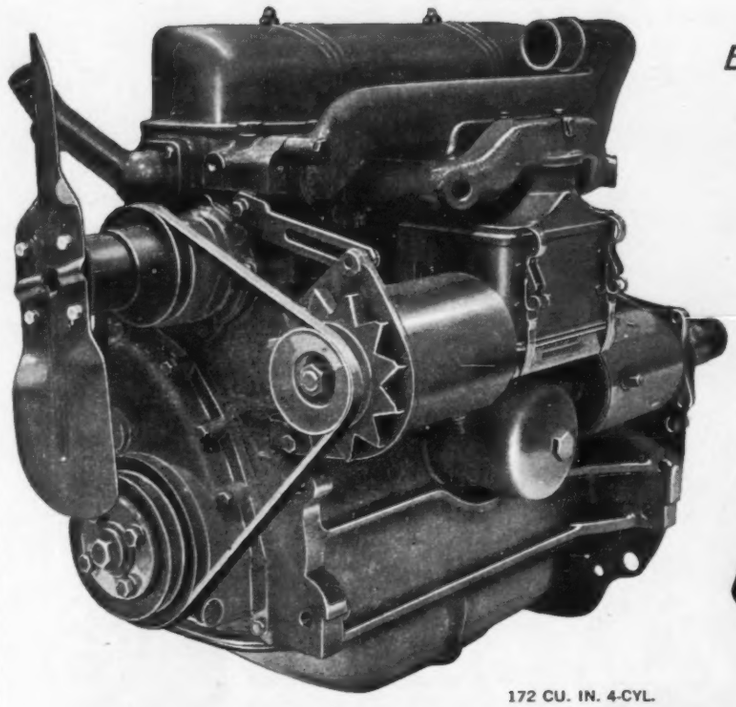

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Bore and Stroke—Inches		3.9 x 3.6	3.94 x 4.52	3.94 x 4.52
Displacement—Cubic Inches		172	220	330
Brake Horsepower	Dynamometer	59 @ 2400	62 @ 2400	99 @ 2400
	80% Dyn. BHP	47 @ 2400	49 @ 2400	79 @ 2400
Torque	Dynamometer	140# @ 1200	151# @ 1600	236# @ 1600
	80% Dyn. BHP	112# @ 1200	121# @ 1600	189# @ 1600
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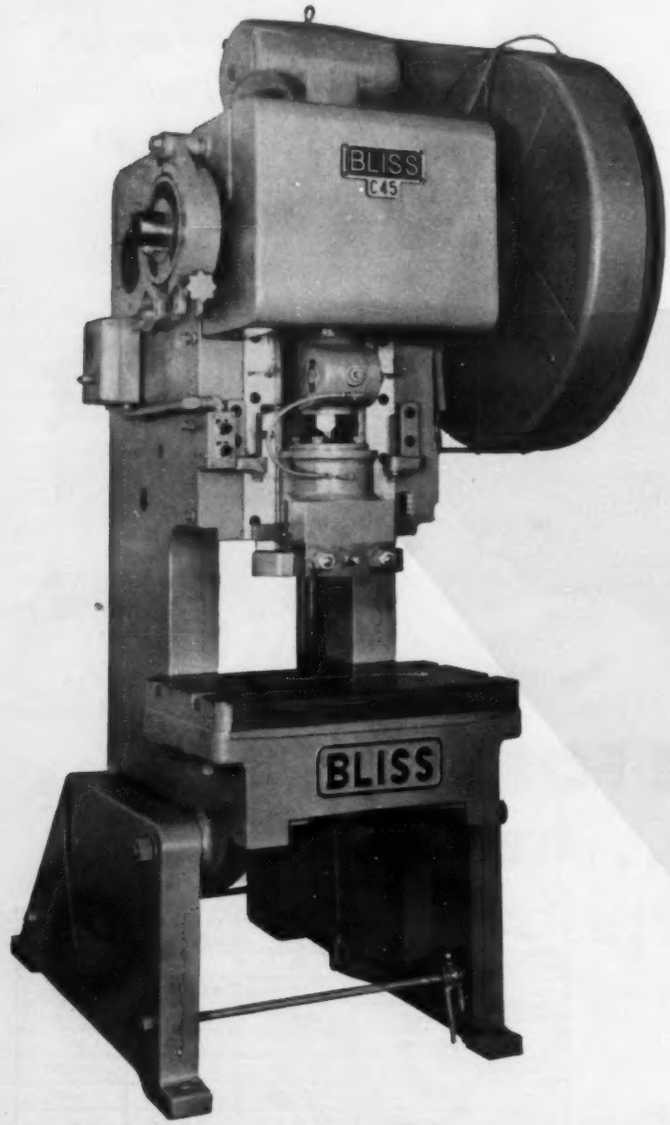

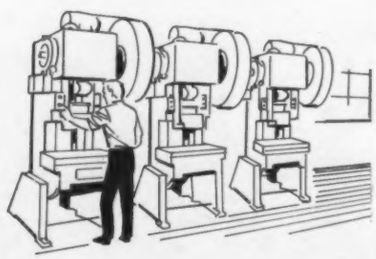

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Fourth Dimension in Design . . .

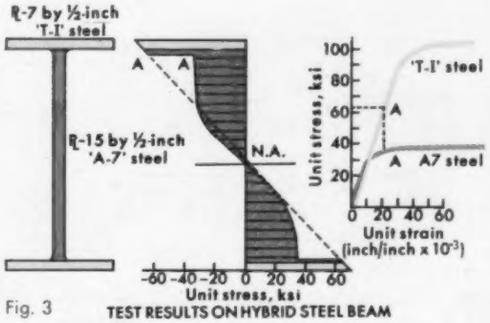

Fig. 3 TEST RESULTS ON HYBRID STEEL BEAM

approach applies a higher-strength steel in the flanges and a lower-strength steel in the web of a beam. In Fig. 3 are shown the results obtained in a limited investigation made at Iowa State University on a beam composed of USS "T-1" steel flanges and an A7 structural carbon-steel web. This beam was loaded to produce strains in the "T-1" steel flanges equal to about twice that associated with yielding of the carbon-steel web. Because the flanges remain elastic when supporting the load (the stress in the flanges was considerably below the 100,000-psi yield strength of "T-1" steel), the strains in the web were under control and could not become excessive. The stress distribution resulting from this loading is shown in the figure. This distribution was obtained by referring the observed strains at various locations in the depth of the beam to the stress-strain curves obtained for the two different steels. Upon relaxation of the test load, a small permanent deflection of the beam was noted. In subsequent loadings, up to the initial loading condition, the beam behaves in a perfectly elastic manner; that is, no additional permanent deflection was incurred. The residual stresses in the web which were incurred on relaxing from the initial loading, being opposite and additive to the applied stresses, produced in the subsequent loading, prevented any further yielding of the web. Thus, hybrid beams made of different strength steels, in the flanges and the web, are capable of prestressing themselves. This could be accomplished either in service or by the fabricator of the composite steel beam.

To the author's knowledge, the first application of different strength steels in the flanges and web of a beam was in the main frame members of flatbed highway trailers. The "J-Rail" section used by Trailmobile, shown in Fig. 4, utilizes "T-1" steel flanges and USS COR-TEN steel in

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the web joined together by welding. The 35-ft-long trailer shown weighs only 8500 lb, but supports a payload of 50,000 lb (see DESIGN NEWS, October 10, 1960, page 98). The application of the different steels in these frame members resulted in 1500-lb weight savings over a previous design for a similar capacity trailer having frame members made of a high-strength steel.

3. Prestressed Steel Construction

The principle of prestressing structural members is not new. Its use in conjunction with concrete is well known. The principle has been applied in steel construction to a limited extent. Essentially, the principle involves the prestressing of a member or structure in a direction opposite to that incurred by the member or structure while in service and holding this condition by various devices. The following represents an interesting application of the "fourth dimension" in design in prestressed beams.

The Iowa State Highway Commission recently let a contract for a 240-ft-long by 30-ft-wide continuous prestressed steel I-beam bridge. This bridge, designed by the Iowa State Highway Commission, will have 73-1/4-ft-long end spans and a 93-1/2-ft-long interior span.

During fabrication, lengths of the beams subjected to positive bending in service will be prestressed to produce negative bending and, likewise, the lengths of the beams subjected to negative bending in service will be prestressed by positive bending. To produce the prestress, lengths of A36 steel wide-flanged beams will be flexed a predetermined amount by the steel fabricator. Then unstressed lengths of USS "T-1" or "T-1" type A steel plates will be tack-welded to the flanges. The lengths receiving the negative moment prestress will receive one plate on the bottom flange of the beam (on compression flange of beam during prestressing), and lengths receiving the positive moment prestress will receive plates on the top and bottom flanges of the beam. When the flexing load is removed, the

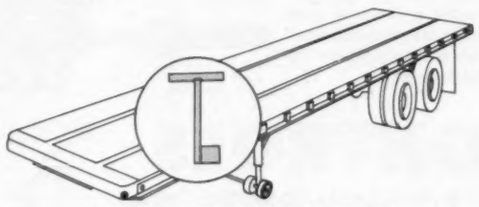

Fig. 4 FLAT-BED TRAILER SHOWING SECTION OF 'J-RAIL' BY TRAILMOBILE

(Continued on next page)

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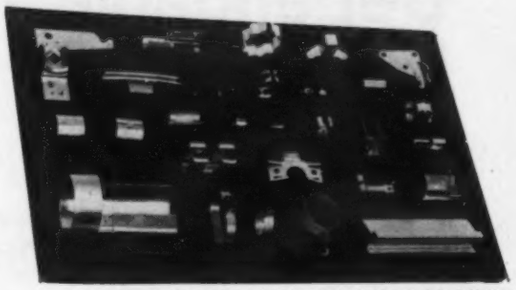

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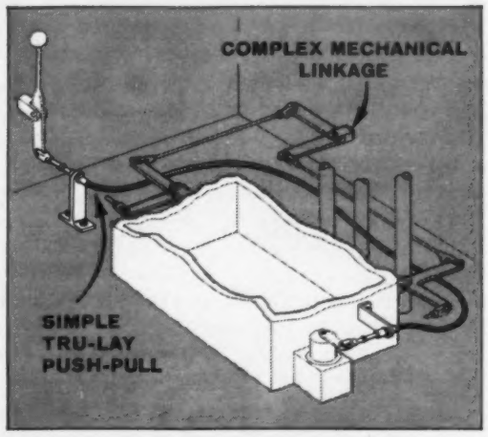

CABLE SIZES AVAILABLE

Control Dimension	Minimum Recommended Radius in Inches	Maximum Input Load in Pounds (Dependent on Travel)
3/32"	2	30
1/8"	3	65–125
3/16"	5	115–175
1/4"	6	300–600
5/16"	8	700–1,000

PUSH-PULL DATA FILE SHOWS HOW TO SIMPLIFY, IMPROVE DESIGN

• Write for your PUSH-PULL Data File. It contains a complete set of engineering bulletins which describe in detail the operation of PUSH-PULL CONTROLS, their applications, features and advantages.

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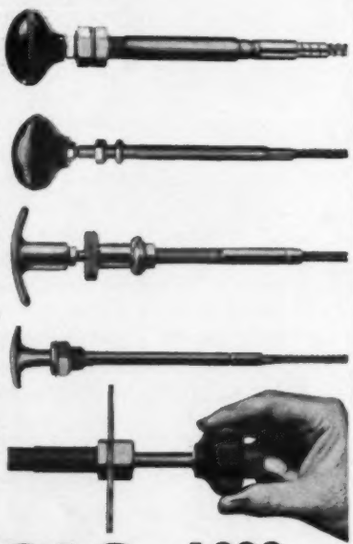
Micro Control • Push or pull the knob for instantaneous response, then rotate knob for vernier adjustment.



PUSH-PULL CONTROLS

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Fourth Dimension in Design . . .

lengths of beams will return to approximately their original shape, but will contain locked-in stresses to offset the stresses to be encountered by the lengths in service. Continuous fillet welds joining the "T-1" steel plates and the carbon-steel beams will be made after the flexing loads are removed. These prestressed lengths will be assembled in the field with either high-strength bolts or rivets. The lengths of prestressed steel beams subject to positive bending in service are designed to act compositely with the reinforced concrete roadway slab. The sizes of beams and plates and the amounts of prestress are calculated so that when the bridge is under design load, the maximum stress in the A36 steel beams is 20,000 psi and the maximum stress in the "T-1" steel plates is 50,000 psi. Typical stress distribution in the prestressed beams and in the same beams when supporting service loads is shown in Fig. 5.

4. **Maintenance-Free Structures**

The previous examples illustrate the application of the "fourth dimension" in design on the basis of the different strengths of the constructional steels. Interesting possibilities exist for the application of this dimension, not only on the basis of strength, but also on the basis of the improved atmospheric corrosion resistance of the higher-strength steels over the structural carbon steels to obtain lighter-weight, lower-cost, maintenance-free or near maintenance-free structures.

The first application of this novel characteristic of a high-strength steel, such as COR-TEN steel in building construction, will be in the John Deere and Co. office building to be built in

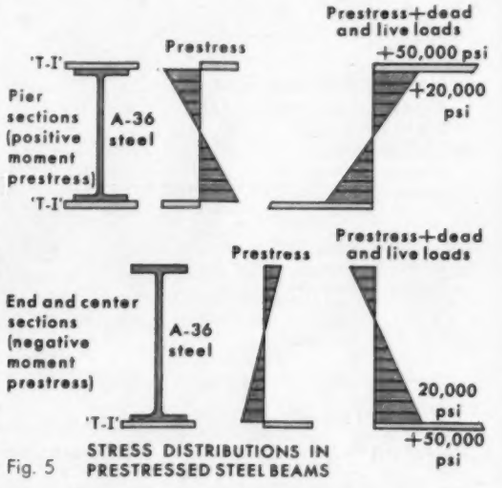

Fig. 5 STRESS DISTRIBUTIONS IN PRESTRESSED STEEL BEAMS

STEEL TRANSMISSION TOWER needs no paint. It is built entirely of unpainted, ungalvanized USS COR-TEN.

Moline, Ill. The use of COR-TEN steel in the unpainted condition in electrical transmission towers is also gaining acceptance.

Space does not permit discussion of the outstanding applications of the "fourth dimension" in the designs that have been achieved in oil-drilling rigs, railroad freight and passenger cars, earth-moving equipment, highway trucks, shipping containers and so on.

Abstracted from a technical paper presented at United States Steel Corp.'s Steel Design and Engineering Seminar, Penn-Sheraton Hotel, Pittsburgh, Pa., April 27, 1961.

The United States Steel Corp. is making available a free booklet containing the unabridged version of this paper plus three additional papers. These are: "Lighter Weight and Lower Cost Achieved with Stronger Steels", Dr. G. Haaijer; "Column Strength of Constructional Steels", Dr. L. S. Beedle et al; "New Steels and Products for Advanced Engineering Design", R. W. Simon. For your copy of the informative design booklet, circle Reader Service No. 548.

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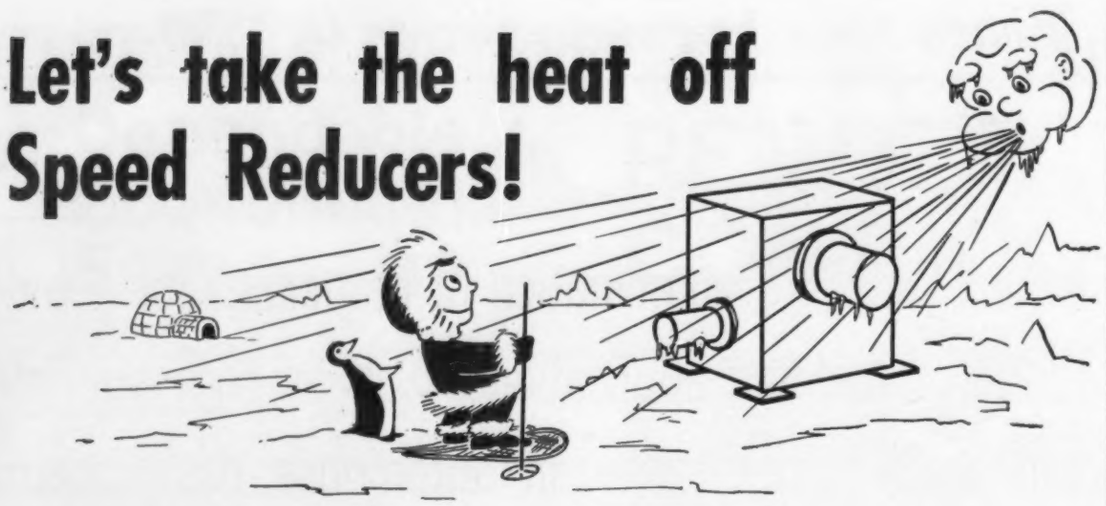
Let's take the heat off Speed Reducers!



A worm gear speed reducer is one of the toughest little customers in captivity. It reduces speeds day-in, day-out, with little complaint. While it works long and hard, it has limitations—set by ratio, center distance, RPM, mechanical and thermal HP ratings, etc. And, depending upon how precisely it was selected and fitted to the job requirements, it will do what it has to do.

But sometimes it's forced to play outside of its league. It must cope with job requirements that vary from here to there—normal 8 to 10 hour service without recurrent shock, the same length of service where there is some shock loading, continuous low-speed service and almost countless others. But the thing that really puts the pressure on reducers, the thing that's lurking in *every* set of job requirements—is h-e-a-t.

When you exceed the thermal capacity of a reducer for more than an hour or so, excessive temperature thins the lubricant resulting in wear; material, bearing and oil seal failures; etc. Of course, the proper lubricant will help but it can't cure the continuing problem of excessive heat.

So how can we lick this toughy? One way is to build the reducer housing oversize, big enough to radiate the heat away and keep temperatures down. But this type sticks out in aisles, louses up compact designs and barks shins. Then, we might try a smaller housing complete with fins on it to dissipate the heat. If this still doesn't work, another trick is to use a reducer with capacities and ratings a step above the ones we need. This is sending a man to do a boy's job. It's impractical, inefficient and costly. There *has* to be an easier, better, saner and cheaper way to do it. And there is!

In certain cases, where the size and type of reducer permits and where we can gain enough in thermal HP rating to keep heat generation in bounds, Cone-Drive Gears does it with fan-cooling.

What's that? Simple. Just add a fan to the worm shaft plus the necessary air shields, fan cover, etc., and presto!—heat is no longer a problem. The air shields direct the fan-pushed air over the fins on the lower portion of the reducer. The fins are shaped and spotted to guide the air stream where it is needed. Thermal HP ratings are boosted tremendously, as high as 147% above those of standard reducers in some cases! Those over-worked, over-heated reducers will now do the job you bought them to do.

Other advantages? They're here in abundance. The size of the reducer stays the same. All parts on a Cone-Drive fan-cooled reducer are 100% interchangeable with parts for standard reducers. Oil capacity is identical. Shields are quickly removed without disconnecting the reducer. (This is important where severe operating conditions make periodic cleaning necessary). The reducer can also be operated *without* fan-cooling just by taking off the fan and shields.

This simple addition to standard Cone-Drive HU speed reducers might be just your answer—might save you some money. Write for Cone-Drive's Bulletin CD-218. It will tell you all about the full line of Cone-Drive double-enveloping worm gear reducers as well as the fan-cooled kind. Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

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PAPERS

Copies of these papers may be obtained by writing to technical society indicated. Addresses follow last item.

ELASTOMERIC ADHESIVES . . . INDUSTRY'S NEW TOOL; *W. C. O'Leary, Adhesives, Coatings and Sealers Div., Minnesota Mining & Mfg. Co., St. Paul, Minn.; ASME No. 61-MD-13; $1; to ASME members, $0.50.*

A discussion of adhesives which are basically elastomeric in character. Includes a large variety of products obtainable from natural, reclaimed and synthetic rubbers in combination with natual and synthetic resins, and with a variety of solvents and diluents.

ELECTROMAGNETIC POWER SYSTEMS FOR SPACE APPLICATIONS; *N. W. Bucci and R. W. Briggs, Westinghouse Aero-Space Dept., Lima, Ohio; ARS No. 61-188-1882.*

Considerations which affect the design and selection of electrical generators, their association controls and conversion equipment. To realize a space power system in the megawatt power level will require extensive effort in development of application and fabrication techniques. A minimum weight energy conversion system results only when an integrated system analysis is used.

A PROFILE OF ALUMINUM ALLOY CYLINDER BORES; *N. W. Smith, Aluminum Company of America; SAE No. 369D; $1; to SAE members, $0.75.*

Wear rates of aluminum alloy cylinders are comparable to commercially used cylinder and cylinder-liner materials. Production economies, reduced weight and improved heat transfer can be gained by aluminum cylinder bores. Increasing laboratory successes and public acceptance of a proven high-production engine with an aluminum bore have stimulated interest and brought about increased activity in all engine fields.

COST AND VALUE OF SMALL TOLERANCES AND SMOOTH FINISHES; *William W. Gilbert, General Electric Co., Schenectady, N. Y.; ASME No. 61-MD-12; $1; to ASME members, $0.50.*

The cost of producing a surface is affected radically by the specifications for tolerances and finish, the process used, the material cut and the volume produced. The product cost can be reduced by the optimum selection of all cost factors through use of the charts in this paper.

STRUCTURAL ASPECTS OF REACTOR AND HEAT EXCHANGER DESIGN; *W. L. Greenstreet, Reactor Div., Oak Ridge National Lab., Oak Ridge, Tenn.; ARS No. 1744-61.*

Certain basic aspects of operational behavior must be examined for a given design regardless of whether it is a reactor component or a heat-exchanger element. This paper applies primarily to high-temperature design. Analytical or experimental methods used in investigating each phenomenon are given and the "state of the art" for each case is summarized.

NITROGEN OXIDES AND ENGINE COMBUSTION; *D. B. Wimmer and L. A. McReynolds, Phillips Petroleum Co.; SAE No. 380E; $1; to SAE members, $0.75.*

Consideration of nitric oxide as one of the factors influencing the combustion behavior of an engine. Ultimate importance of nitric oxide effects in influencing

such practical results as octane blending behavior and knock rating differences between engines is not known with any certainty at present.

FACTORS AFFECTING THE DESIGN OF RELIABLE ELECTRICAL CONTACTS; *Morris A. Oliver, AMP, Inc., Research Div., Harrisburg, Pa.; AIEE No. CP A 61-5020.*

Some of the parameters concerned in the design of reliable electrical contacts. A discussion of accelerated life tests currently in progress indicates that a properly crimped terminal of the type described, operating under normal conditions with practical failure levels imposed, will support and complement equipment reliability.

TENSIONS IN STRAIGHT AND CURVILINEAR BELT CONVEYORS; *W. A. Windler, Senior Design Engineer, Utah Construction & Mining Co., Palo Alto, Calif.; ASME No. 61-SA-11.*

A simplified method of tension calculations in belt conveyors suggests the same approach regardless of whether the belts are straight or curvilinear. A Key Diagram is introduced for quick identification of critical tensions for all basic conditions. This method permits establishment of tension values for the design of concave and convex curves and also for the design of drive and take-up when not located at conveyor ends. The purpose of this paper is to present a faster way to find all belt tensions necessary for the proper design or selection of conveyor components.

GAS TURBINE SHAFT DYNAMICS; *Glen Hamburg and Jon Parkinson; Continental Aviation and Engineering Corp.; SAE No. 382B; $1; to SAE members, $0.75.*

Describes the effect of compliance in the bearing support structure on critical speeds for high-speed turbine rotors. Compliance can be adjusted to advantage by means of a simple cantilever spring system of much lower stiffness than the general structure. The use of a model to examine some of the vibrational characteristics of a proposed engine design prior to commencing full-scale engine development is discussed.

THEORETICAL PRESSURE DISTRIBUTION IN JOURNAL BEARINGS; *Kichiye Habata, Research Engineer, Satō Agricultural Machine Mfg. Co., Shimane Prefecture, Japan; ASME No. 61-APM-20.*

By assuming oil viscosity constant, Reynolds'. equation for journal bearings has been solved in a manner similar to Hill's method. Two approximate solutions using E. O. Waters' method and Ritz's method have been added. In order to show a justification for assuming the viscosity constant, the Reynolds' equation was solved for the infinitely long bearing with variable viscosity and the solution was compared with that of Sommerfeld.

American Institute of Electrical Engineers, 33 W. 39th St., New York 18, N. Y.
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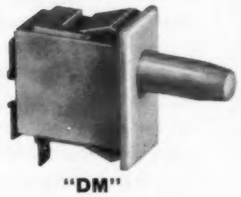
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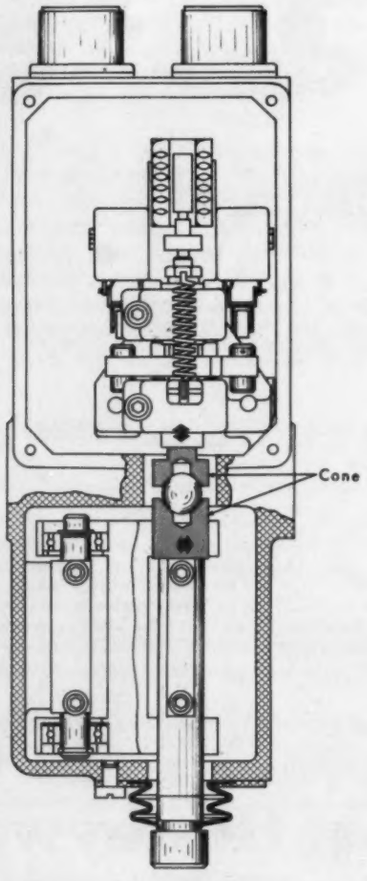
Pantograph Stylus Mounting Eliminates Lost Motion, Maintains Tracer Sensitivity

E. J. Stefanides, Central States Editor

Problem:
Design a single-axis (180-deg) tracer head for machine tool contouring control systems. Stylus of tracer must be able to be deflected from any point in circle and must provide an output signal proportional to error between actual position and position stylus should occupy. Tracer must be free of lost motion or undue friction and should have a constant sensitivity independent of stylus length. It must also be easily adapted to both hydraulic and electric systems, and readily convertible to two-axis (360-deg) and three-axis systems.



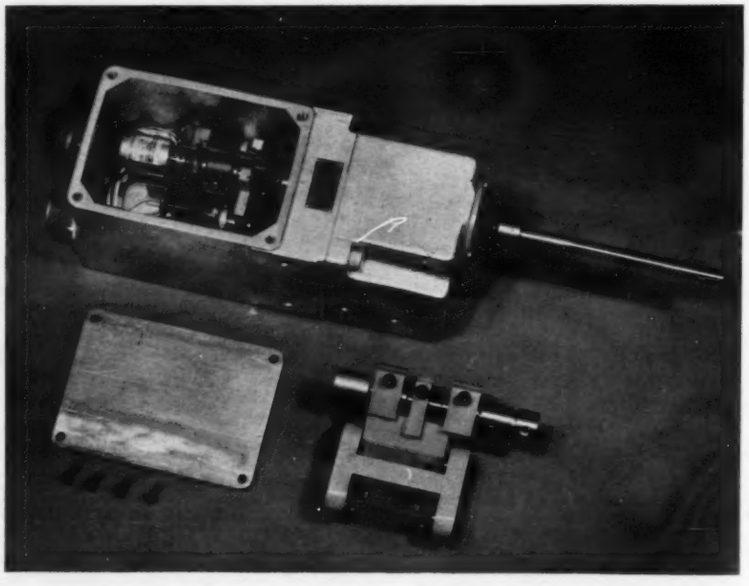
Solution:
These problems were solved by a tracer head design in which the stylus system is mounted on a pantograph or double-hinge linkage supported by adjustable ball bearings. This method of mounting eliminates lost motions and undue frictions, and provides a tracer whose sensitivity is not affected by stylus length.

With the pantograph arrangement the stylus is always held vertical and always describes a circle of the same diameter. Thus, the stylus generates a neutral cylinder and sensitivity of the tracer is independent of stylus length.

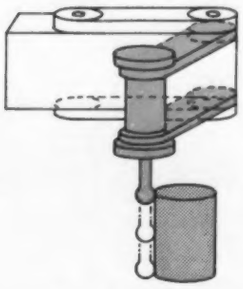
Transfer of the stylus motion to the sensing device is accomplished by a ball and two inverted cones. The upper cone is fastened to the bottom of a vertical shaft which rides in linear ball bearings that may be adjusted to eliminate lost motion. This shaft carries the sensing element which may be either the core of a differential transformer or the spool of a hydraulic valve. The shaft is spring-loaded downward to hold it in contact with the ball and hold the ball in contact with another inverted cone in the stylus support element. As the stylus is moved radially, the bottom cone moves off center, causing the ball and top cone to transmit a vertical motion to the sensing-element shaft modulating the output signal. To keep the unit within the control range, a bracket has been added to the sensing element shaft to actuate limit switches. This provides shifts for a fast traverse to return tracer to null when predetermined limits are exceeded.

In addition to providing an output signal proportional to error, this arrangement can be made very accurately. The ball of this arrangement is inherently very accurate and the cones are easily ground to an accurate taper and concentricity. Conversion of the unit to a 360-deg tracer can be accomplished by external switching while three-dimensional control is provided by a special bottom unit, which allows vertical movement of the stylus.

This tracer unit was designed and is manufactured by the Kase Mfg. Co., Cleveland, Ohio, for the Reliance Electric and Engineering Co. of Cleveland, manufacturer of the contour-tracer control systems with which it is used.



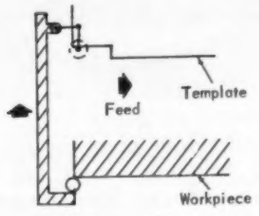
PANTOGRAPH or double-hinge linkage is mounted upon ball bearings in such a manner that end play and lost motion can be taken up easily by adjustment. Radial displacement of stylus is translated into vertical component by ball between two inverted cones. Lower cone is fixed to stylus mounting element. Upper cone is fixed to spring-loaded, movable vertical shaft. Shaft is mounted in movable linear ball bearing supported by clamps, which can be tightened to remove all lost motion. Vertical shaft carries sensing element, in this case differential transformer core. It also carries bracket which supports actuating screws of limit switches. Switches actuate high-speed shift to provide fast traverse to null when limit is exceeded.



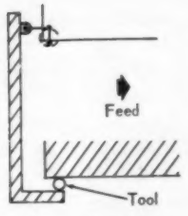
DOUBLE HINGE LINKAGE

BALL-SWIVEL PIVOT

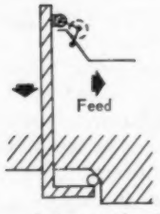
PANTOGRAPH LINKAGE always maintains stylus in vertical position. Stylus therefore, generates neutral cylinder rather than neutral cone, and sensitivity of tracer is not affected by variations in length of stylus.



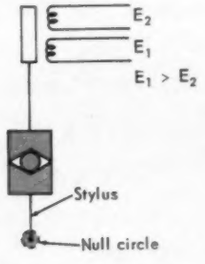
Stylus on mechanical neutral

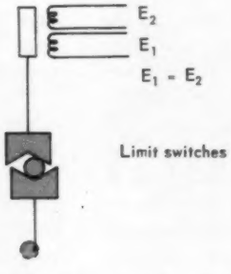


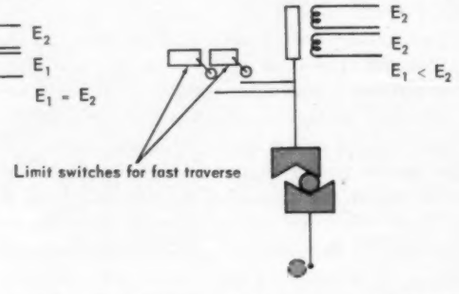
Stylus on null circle



Stylus outside null circle





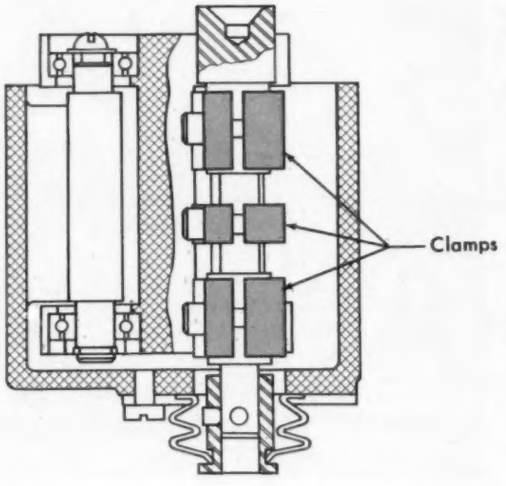


SCHEMATIC shows essential functions of tracer head as applied to one-axis (180-deg) tracer control system where feed is independent. Mechanical neutral and null circle have fixed spacial relationship to tracer head and tracer mounting.

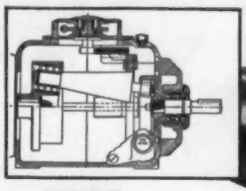
Within null circle, output signal moves tracer and tool toward template. With stylus displaced to any point on null circle, voltages balance and output signal is zero. Outside of null circle, output signal reverses.

CONVERSION TO THREE-DIMENSIONAL TRACER HEAD is accomplished by mounting stylus-holding element (lower vertical shaft) on linear ball bearings. Tracer head then becomes sensitive to both side and end force on stylus. With this conversion it may be used for deep-cavity work as on rise and fall milling machines.

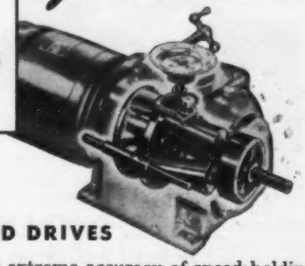
TRACER HEAD is signal producer used in contouring-control system for machine tools. Signal produced is proportional to error that exists between position tracer should occupy and its actual position. Basic mechanism is classified as 180-deg tracer which approximately describes quadrants it can follow. By external switching it can be converted to 360-deg class. It also can be converted to 3D (three-dimensional) tracer by use of special bottom unit. Maximum operating range of unit is 0.100 inch. Range is linear from 0.01 to 0.100 inch. Operating force required is 3-5 lb.



INFINITE RANGE
EXTREME ACCURACY...



Get Both



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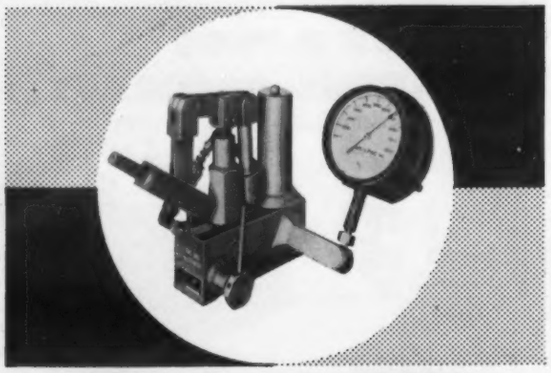

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- ¾" Stroke
- Self-sealing valves
- Up to 50,000 psi
- For high pressure static testing

The new PINE Model 50M Hand Operated Hydraulic Pump develops pressures up to 50,000 psi. Designed primarily for high pressure static testing, the Model 50M has a ⅜" piston, ¾" stroke and bubble-tight, self-sealing valves and release screw. Piston, barrel and valve block are of heat treated alloy steel. Intake and pressure release valves are contained within the unit. Pressure gauge optional. Weight: 60 lbs. complete with 36" pump handle.

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Magnetic Amplifiers Control Traction on Saturn Tower

Edward W. Schrader, Western Editor

A dual magnetic-amplifier motor control eliminates switching in the operation of the traction drive for the Saturn Missile Tower. Four trucks carry the tower, each truck driven by a 100-hp motor. The two trucks on each side have their motors connected in series. This uses the principle of load-sharing found in d-c motor operation for cranes.

Closing the master switch in the control console releases all thruster brakes on the drives. The initial movement of the master switch applies an unbalancing current in the magnetic amplifier windings of the preamplifier. This unbalance in the control winding furnishes a higher voltage in the forward direction to the exciter, which in turn furnishes a voltage on the motor armatures, causing torque in the forward direction. Further movement of the variable transformer master switch increases the reference voltage in the forward direction to increase forward motor speed. Similarly, movement of the master switch in the reverse direction provides torque on the motors in the reverse direction.

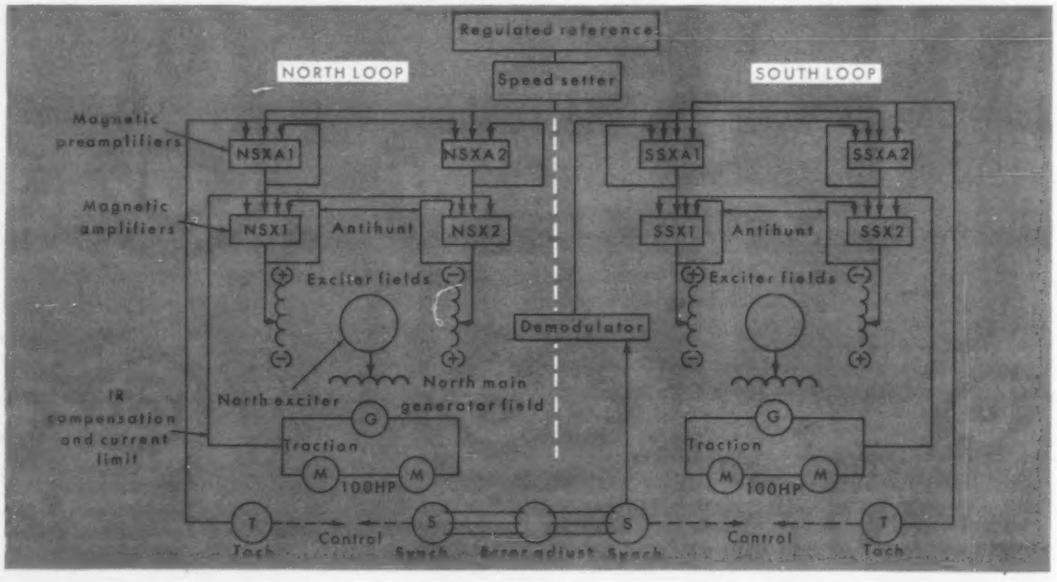
Both the north and the south side of the tower have essentially the same loop circuit. The magnetic amplifier windings SSX1 and SSXA2 are connected to oppose each other across the interpole winding of the generator to provide IR compensation. The amount of compensation may be adjusted.

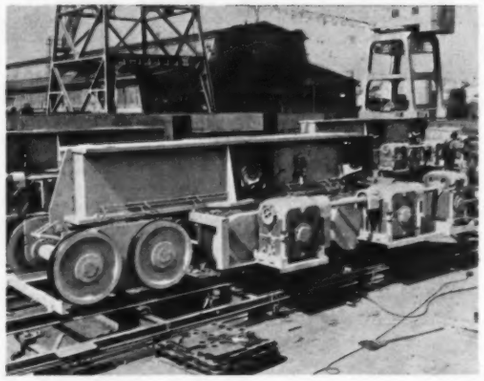
The magnetic amplifiers have five control windings. Smaller magnetic amplifiers serving as preamplifiers, combined with larger magnetic amplifiers operating directly in the exciter fields, give a total of seven control windings.

The four preamplifiers receive the reference voltage from the master switch to establish speed, as well as a tachometer generator voltage and a feedback from their own output into one of the control input windings. This arrangement increases the stability of the system.

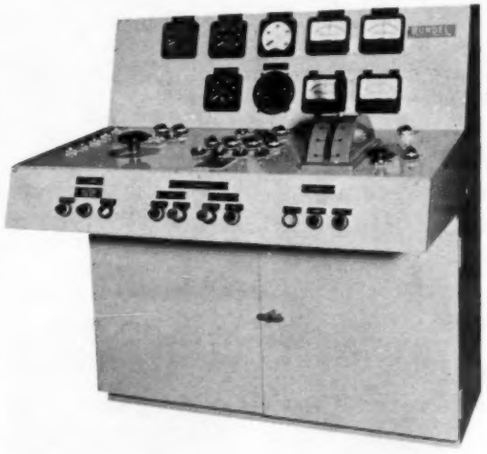
The output of the four preamplifiers then is fed into the main magnetic amplifiers. These amplifiers also have feedback for IR compensation, current limiting and antihunt.

The Saturn Missile Tower was erected for NASA under the supervision of the U. S. Army Corps of Engineers. Electrical circuit design is by Rundel Electric Co., Millbrae, Calif., under subcontract to Pacific Coast Engineering Co., Alameda, Calif., who has responsibility for the traction drives. The tower contract was administered by the Fabricating Div. of Kaiser Steel Corp., Los Angeles, Calif.





TRACTION DRIVE UNITS are 12 wheel trucks. Eight wheels of trucks are driven by 100 hp d-c motor through three right-angle speed reducers. Sand boxes for increased traction are provided on drive truck wheels. Selsyns, for error adjustment of skew, are mounted on small trailer wheels. These wheels are match ground to plus or minus 0.001 inch in dia. Builtin skew error is limited to 1/2-inch linear over run of 642 ft.



CONSOLE for traction control.

TRACTION DRIVE SYSTEM block diagram for Saturn Missile Tower shows north and south loops for motor control. Magnetic preamplifiers are designated NSXA1, NSXA2, SSXA1 and SSXA2. Larger magnetic amplifiers are designated NSX1, NSX2, SSX1 and SSX2. Error adjustment for skew feeds demodulated voltage to south loop, thereby correcting speed of traction motors on south side of tower. Deceleration is limited to from 0.001G to 0.03G. Tower has 90-ft centers and maximum allowable skew is two inches.

PRODUCT-DESIGN BRIEFS FROM DUREZ

- Hetron® for outboard motor shrouds
- Plastic potentiometer
- Dip-coating compounds

Great for waterways

One key advantage of Hetron polyester resins is durability under stress. This quality turns out to be particularly pertinent for Gale Products, a division of Outboard Marine Corporation.

In the outboard motors produced by this Illinois firm, shroud permanency was a problem. The solution was to make them of Hetron reinforced with fibrous glass. A critical step in the production process consists of two baking operations at 240°F. The material takes the bakes without crazing.

In use the shrouds won't crack,

GALE PRODUCTS

craze, or corrode. They resist denting and abrasion, have high impact strength, are lighter than metal covers (about 3 lbs. lighter in the case of a 50-hp motor), protect motor parts from water spray, are about 15% less expensive to produce than metal covers.

An additional benefit is the transformation of the motor's roar to a pleasant purr, which permits boaters to enjoy conversation with their sport.

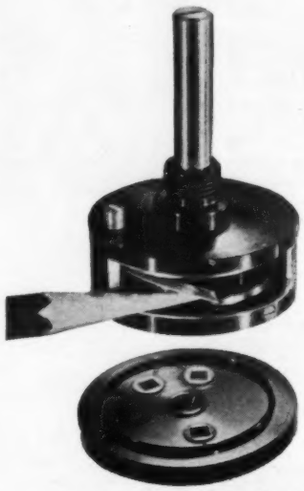
Hetron resins have properties that make for superior performance in a wide variety of applications. We'll be happy to send you detailed information on this family of premium polyesters.

Look—no coils

Get to the heart of a new and better product, and often you'll find a Durez plastic.

For instance: this little precision potentiometer. It's better because it's simpler—contains no resistance wire, no varnish, no cement to come unstuck and cause failure.

Instead, the metallic wiper (at pencil point) rides on an almost friction-free plastic ring, the resistance element. The



NEW ENGLAND INSTRUMENT CO.

ring is made of diallyl phthalate resin mixed with carbon. The buttonlike insulating base is a standard Durez diallyl phthalate molding compound.

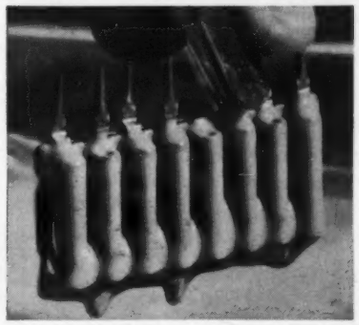
Potentiometers made with these materials just don't seem to wear out. Nor do they lose their excellent insulation properties in clammy surroundings. For these reasons, the little instruments are being specified widely for missile and rocket control systems, computers, and servo gear.

When your design project needs a moldable material of far-better-than-average electrical properties—*plus* resistance to moisture and heat—think of Durez diallyl phthalate molding compounds. We'll gladly send you facts about them.

Coat for components

Looking for a simple encapsulating idea? Here's one that works well at heatproofing, moistureproofing, and preventing shorts in small electrical components. It's non-messy, too.

Dunked in a paste coating, dried, then baked for a short time, components steadfastly resist extremes of heat and moisture that would otherwise raise havoc with their electrical reliability.



Components so coated can be soldered into a circuit without causing the coating to melt or peel. It won't soften, and easily passes a series of −55 to +85°C cycles. One thousand hours at a sweltering 150°C will turn the coating almost black, but still won't materially affect the component inside.

The paste is made with Durez phenolic resin-and-filler compounds supplied in powder form. After baking, it is impervious to ketone solvent cements sometimes used in assembling radio and TV chassis.

What can these dip-coating compounds do for you? We'd like to help you find out. Write for more detailed information.

For more information on Durez materials mentioned above, check here:

- ☐ Bulletin D-6: properties and applications of Hetron fire-retardant resins
- ☐ Data sheets: facts about diallyl phthalate molding compounds
- ☐ Data on phenolic resin compounds for dip-coating

Check, clip and mail to us with your name, title, company address.

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THESE TOUGH, HIGH-CONDUCTIVITY COPPERS ARE MACHINABLE

A semi-conductor base is a typical application of electrical copper demanding—

- strength to withstand high torque,
- high thermal conductivity,
- machinability.

Ideal for such requirements are these five alloys from Anaconda:

DLP Copper-104 (deoxidized low phosphorous)

OFHC* Copper-120 (oxygen-free high conductivity)

Tellurium Copper-127

Chromium Copper-999

Amzirc* (Zirconium Copper)-134

Each of the above provides a slightly different combination of desirable properties, and all can be machined as required to achieve necessary accuracy and maintain reasonable production costs.

Anaconda Specialists can help you select the right alloy and form of metal —and the manufacturing method best suited to meet your design and fabrication problems. They can help you utilize cost-cutting techniques, such as roll threading of studs, and advise you on welding and brazing procedures. Whatever your problems, Anaconda offers specialized technical help.

Anaconda Publication C-34 provides useful data on composition, typical physical and mechanical properties, forms available, and fabrication methods. For this publication, or technical assistance in applying these electrical coppers, address: Anaconda American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-016

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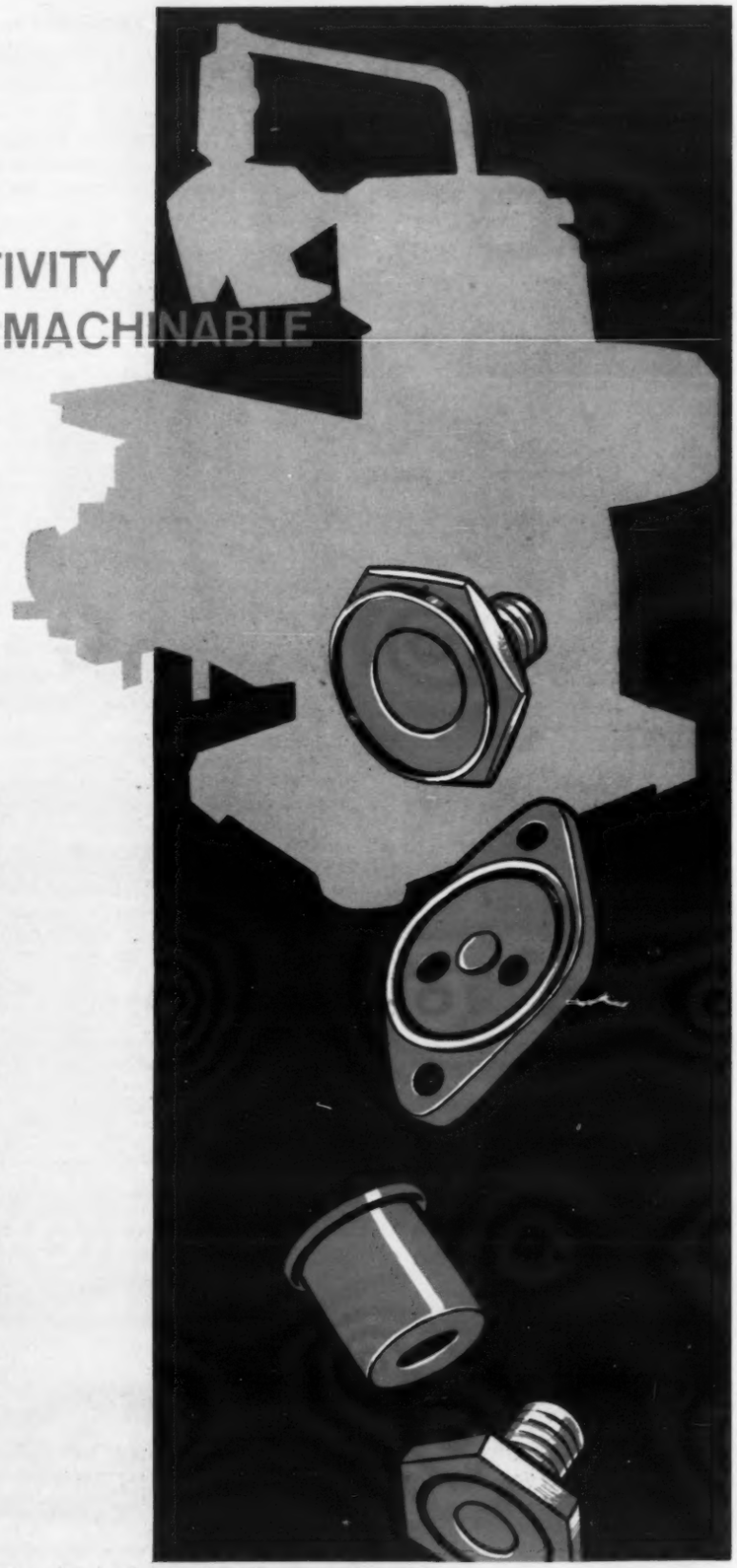

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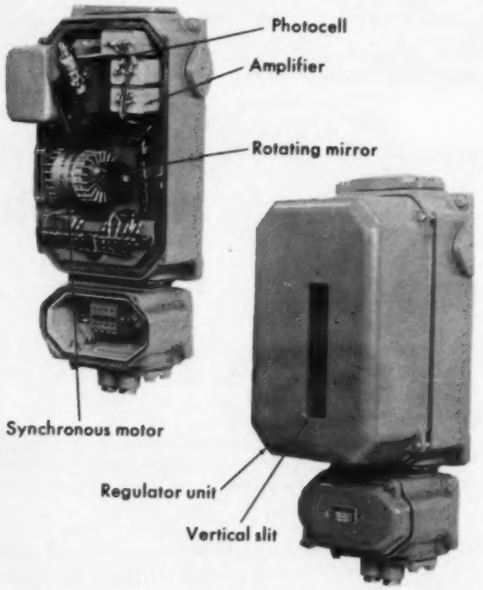
Rotating Mirror

Volrath Holmboe, Correspondent in Sweden

Automatic control of loop height in a rod-rolling mill is obtained by means of a rotating mirror, which reflects infrared radiation from the rod to a photocell. Known geometric relation between loop height and the mirror's angular position when the photocell receives impulses is used to produce a control voltage proportional to the deviation of the loop from normal. The control voltage is fed to motor field windings to obtain proper speed adjustment. The arrangement is claimed to keep loop height practically constant.

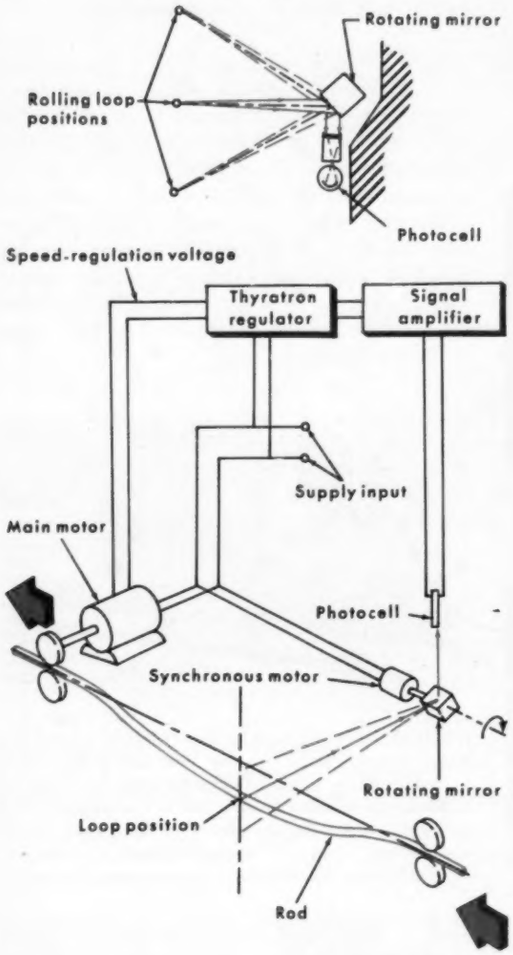
Mechanical contact between regulator and rolling rod, which might produce undesirable stresses or scratches in the material, is eliminated. The rod hangs freely between rolling stands. High-accuracy control of loop height also permits reduction of distance between the stands, cutting heat losses and space requirements.

The loop regulator, developed by ASEA, Vasteras, Sweden, can be used for any applications where the angular position of a hot medium is of interest.

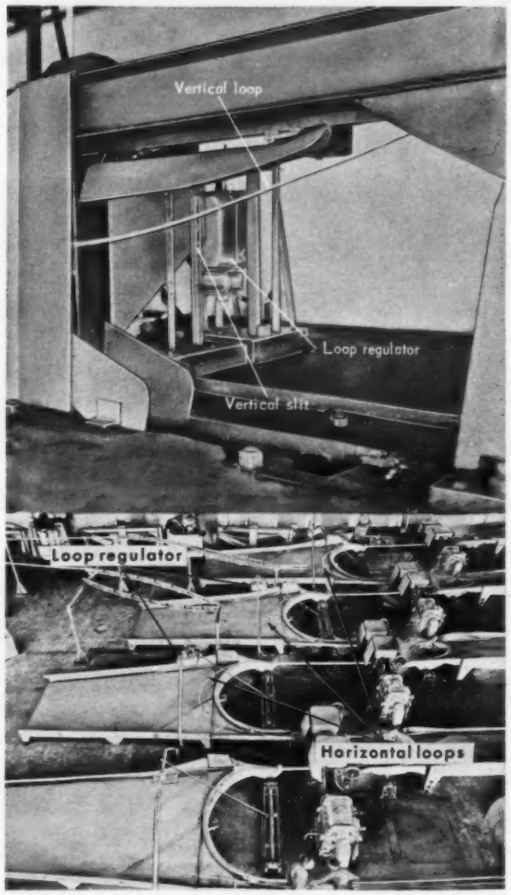


CUBIC ROTATING MIRROR and photocell with amplifier are housed in common unit. Four reflecting surfaces provide four impulses to photocell per revolution. Infrared radiation enters unit through long vertical slit in cover. Photocell is sensitive to temperatures above 300C.

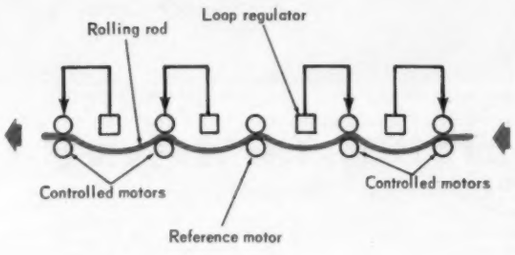
Reflects Light to Photocell, Governs Rolling Speed



ROTATING MIRROR is driven by synchronous motor at supply frequency. Mirror reflects infrared radiation from rod loop to photocell. Photocell impulses are amplified and transmitted as ignition pulses to thyratron regulator with anode voltage in phase with synchronous motor. Arrangement provides linear relation betwen regulator output voltage and loop height. With zero voltage for optimum loop height, output voltage will be proportional to deviation in loop position. Output voltage is used as control voltage and is superimposed on motor field to obtain proper speed control.



CONTROL SYSTEM applies to rolling loops of vertical and horizontal types. Loop height accuracy of ±10 cm are achieved. One-percent speed error at normal rolling conditions will reduce loop height of 40 cm to zero in about 2 sec with consequent stretching of rod.



CONTINUOUS ROD MILL uses motor for speed reference. Regulators in front of reference motor will control motors ahead of loops and regulators behind reference motor will control motors after loop.

MORE AND MORE USERS ARE STANDARDIZING ON THIS PNEUMATIC REGULATOR

there's a reason!

- ✓ 6500 psi inlet pressure.
- ✓ Eleven outlet ranges from 0 – 5000 down to 0 - 60 psi.
- ✓ Constant outlet pressure regardless of changes in inlet pressure.
- ✓ Integral relief valve — requires no separate adjustment.
- ✓ Temperature range —65°F to +275°F.
- ✓ Low in cost — Immediate delivery.
- ✓ Light Weight (4½ lbs.).
- ✓ Available with manual or electric remote control.

Hi flow — helium, air, nitrogen.
QUALIFIED TO MIL-E-4970

BENBOW manufacturing corporation
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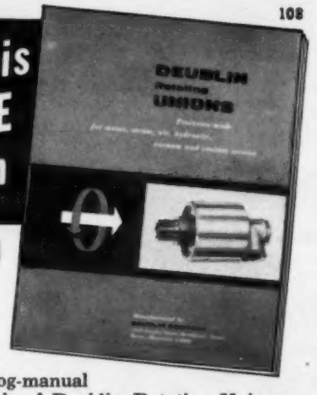
DEUBLIN Rotating UNIONS



A completely new, 20 page illustrated catalog-manual showing all the models of Deublin Rotating Unions for water, steam, air, hydraulic, vacuum and coolant service for the machines you make or use, is just off the press to help you get trouble-free service and reduce your "down-time" and keep maintenance to a minimum. Shown are rotating joints for water and steam service; monoflow and duoflow unions; single and double passage rotating air unions; hi-pressure lo-torque unions; extra capacity air unions; rotating siphon pipe unions; in-the-shaft mounted unions; hydraulic rotating unions and hi-speed coolant unions. Complete with full engineering data, cut-away drawings, plus instructions for installing, lubricating and servicing Deublin unions.

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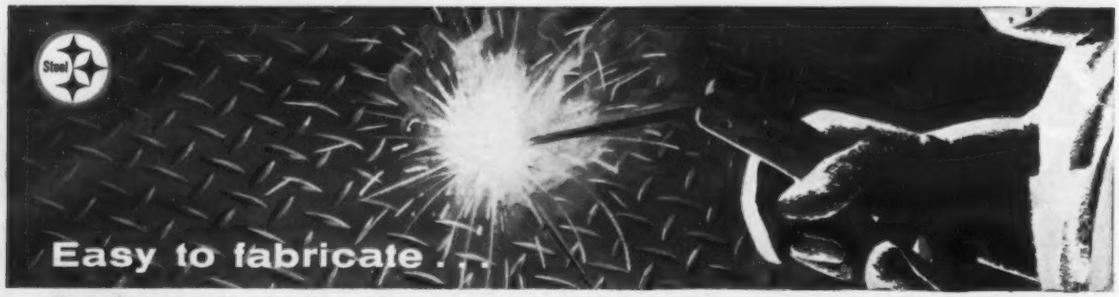
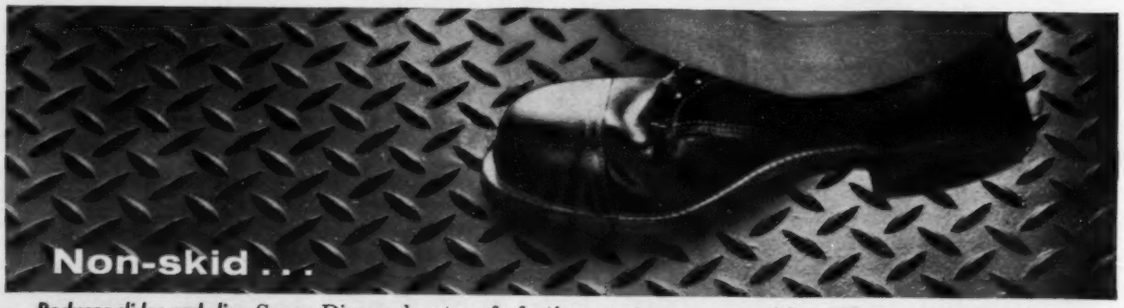


Shear, form or weld A.W. Super Diamond with standard shop equipment. Pattern matches any angle.

SUPER DIAMOND

Sweep, hose or mop A.W. Super Diamond. Water drains off in all directions. No pockets to hold dirt.

FLOOR PLATE



Reduces slides and slips. Super Diamond puts safe footing on steps, ramps, aisles; aids traction even if wet.

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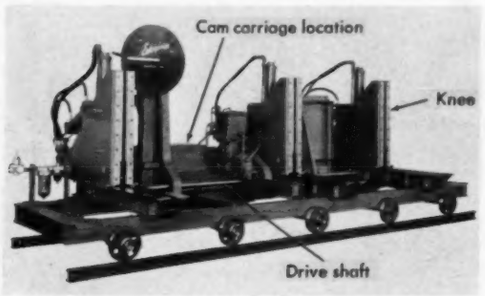
Measured Volumes of Fluid

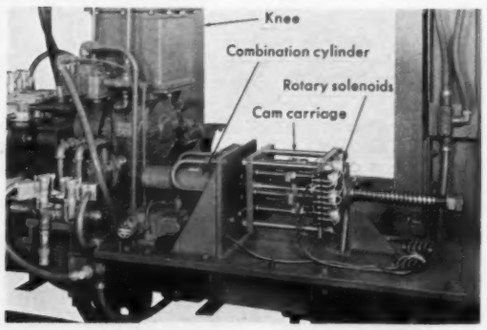
E. J. Stefanides, Central States Editor

The hydraulic control system of a new sawmill carriage measures volumes of fluid to linearly index the log relative to the saw blade. The measured volumes of fluid provide the feedback reference measurement which halts traverse of the log and determines thickness of the sawed board.

The log is moved across the carriage bed by three knees to which retractable tong dogs are attached. The knees are driven through a positive mechanical drive by an air motor which also drives the positive-displacement, hydraulic-piston pump of the control system.

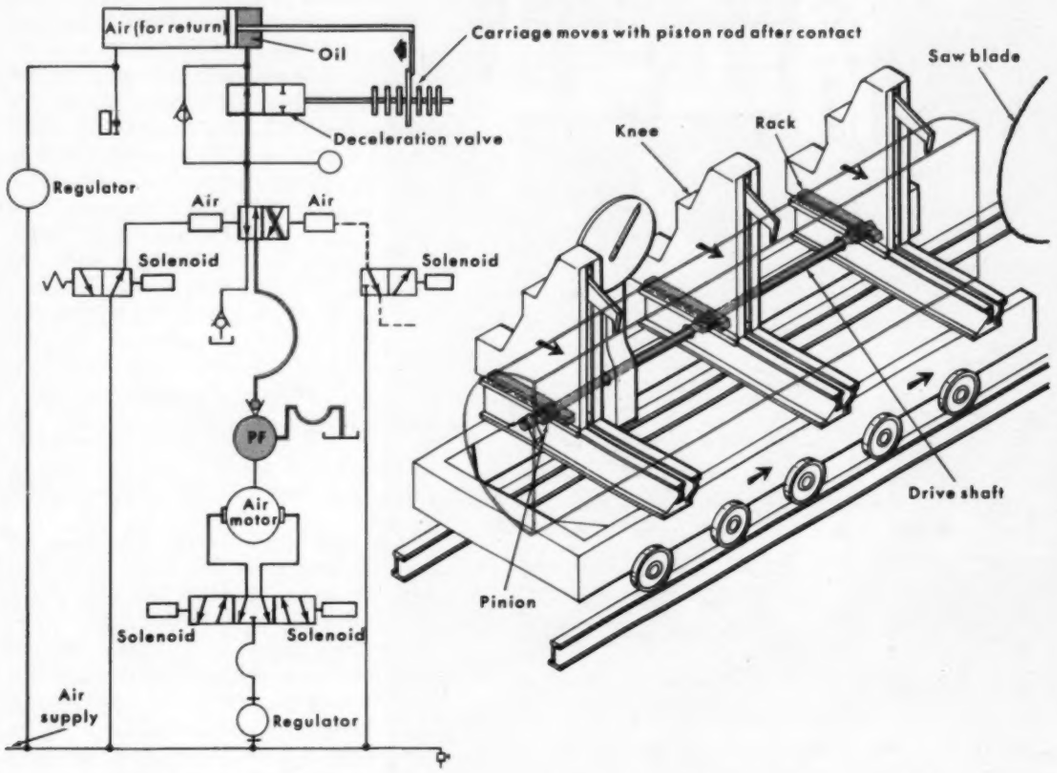


MEDIUM-DUTY AUTOMATIC SAWMILL CARRIAGE travels along rails to feed log into saw blade. Log is secured to three L-shaped knees by tong dogs (retraced into knees in this illustration). Dial at top gives continual indication of distance from back of log to centerline of saw blade.



VIEW OF "HYDROSET" INDEXING SYSTEM from back of carriage. Cams which determine sawed thickness are mounted on separate carriage and arranged in circular configuration. Each cam has a rotary solenoid, which when energized, places it in command of indexing operation.

Control Sawmill Carriage Indexing



KNEES MOVE on slides arranged across carriage bed. Their movement is synchronized by individual racks which are driven by gears mounted on a common shaft. Gear shaft is chain-driven from gear-reduction unit driven by air motor. Air motor also drives positive-displacement hydraulic pump of indexing control system.

During indexing, the hydraulic pump delivers fluid through a four-way valve and a decelerating valve to the hydraulic side of a combination pneumatic-hydraulic cylinder. The fluid moves the piston toward the center of the cylinder. As the piston moves, it contacts a preselected cam. This puts the cam carriage in motion. A plunger attached to the cam carriage contacts the deceleration valve, gradually closing it off. As the deceleration valve closes, hydraulic pressure rapidly builds up in the fixed volume of the pump line, stalling the air motor and actuating a pressure switch to shut off the air to the motor, which stops log carriage traverse. After a time delay, solenoid air valves are energized to reposition the four-way valve. Regulated air pressure on the pneumatic side of the cylinder returns the measured volume of fluid to the reservoir and returns cam carriage, resetting the system.

This method of indexing provides a rugged system capable of greater accuracy than previous systems. System accuracy is not affected by extremes in ambient temperature and can be equipped for indexing to a large number of non-incremental board thicknesses. Selection of various board thicknesses is provided by an arrangement of simple cams operated by rotary solenoids. Energizing a particular solenoid rotates a cam so that it is in command of the indexing operation and determines the axial travel of the cylinder at which the deceleration valve will close.

This sawmill carriage was designed and is manufactured by the Enterprise Co., Columbiana, Ohio, a division of the Wm. K. Stamets Co.

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TEFLON SEAL
Saves hours in piping installations
PAT. PENDING
Eliminates leaks in oil, air, water, vacuum, chemical lines
Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—without the use of pipe dope. Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.
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Thread Tru-Seal on pipe or fitting as far as it will go hand tight.
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Thread pipe or fitting 3 threads into port. Point in desired direction.
Tighten Tru-Seal to complete leakproof assembly (only light torque required).
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TWICE as many Timing Contacts
—SAME PANEL SPACE!
NEW 2-POLE TIMING RELAY mounts in same space as single-pole timer
CLASS 9050 TYPE B 2 pole TIMING RELAY with instantaneous contacts
PLUS these advantages:
• Easily converted from on-delay to off-delay or vice versa
• 1 or 2 single pole double throw instantaneous snap switch interlocks available
• Timing adjustable from 0.2 seconds to 3 minutes
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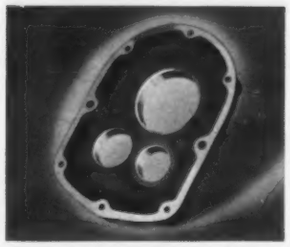
...the quality-engineered package

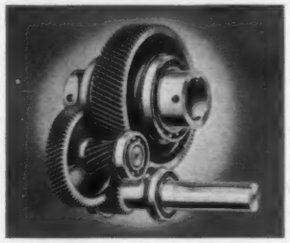
that simplifies speed reduction

DODGE TORQUE-ARM, America's most widely used shaft mounted speed reducer, will save money for *you.* No foundation, no sliding motor base, no flexible coupling, no installation fuss. Developed and perfected by Dodge, this reducer has been so widely accepted in industry that it is now built and stocked in this unmatched range of sizes and models: capacities up to 170 hp; output speeds from 10 to 400 rpm; ratios of 5:1, 15:1, 25:1; speed ratios up to 175 to 1 with correct selection of speed reducer and V-belt drive. Built-in backstop available. Also positive overload release. Vertical models. Flange mounted models. Special application models . . . Go modern—go Torque-Arm! See your Dodge Distributor, or write us.

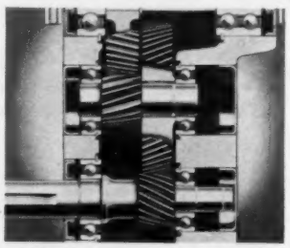
Dodge Manufacturing Corporation, 300 Union St., Mishawaka, Ind.



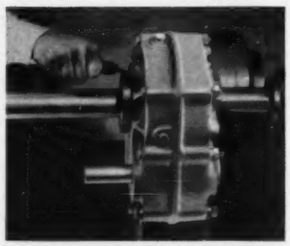
Rugged, semisteel housing holds bearing seats in line for entire life of unit. Laughs at loads. Corrosion resistant.



AGMA rated helical gears. Soft cores withstand shock; hardened surfaces defy wear. Teeth are crown shaved.



Gears are located *between* bearings and carry their loads without strain. Longer life, higher efficiency.



Unit slides completely onto shaft and locks on *both* sides of housing. This baby stays *put*—runs truer longer.

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CALL THE TRANSMISSIONEER, your local Dodge Distributor. Look under "Dodge Transmissioneer" in the *white* pages of your phone book. Factory trained by Dodge, he can give you valuable assistance.

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NEW BOOKS

MILLIMETER-TO-INCH CONVERSION has been published in table form in a 27-page publication, "INSTANT TWO-WAY CONVERSION", by E. Joe Penn, 4910 Carson Ave., Indianapolis 27, Ind. The "International Inch", 25.40000 mm, became effective July 1, 1959, and 0.0393700787 inch per mm were used as factors to produce these tables. Tables may be used for conversion from 10.00 to 100.00 inches and from 254 to 2540 mm, by decimal manipulation. Results will be in increments of 0.01 inch and 1.0 mm. The need for two separate tables is eliminated by the inclusion of even millimeters and 0.1 mm in their respective locations. The even millimeters have been underscored for greater ease in spotting. Values in these tables were copies directly from calculator tape and have been checked thoroughly. The increase in exchange in engineering and manufacturing practices between countries which use different units of measure prompted the publication of this brochure-styled book. Price: $1.

TWO NEW DOVER PUBLICATIONS trace the development through the ages of the fascinating branches of learning. "A SHORT ACCOUNT OF THE HISTORY OF MATHEMATICS", by W. W. Rouse Ball, offers a panoramic view of the rise of mathematical ideas from the Egyptians to the mathematical giants of the 19th Century. This 522-page book, written for the nonspecialist, is a pocket encylopedia of the great names in mathematics and their contributions. Using a biographical approach, the author discusses the discoveries of Hindu, Chinese and Arabic mathematicians, the works of Roger Bacon, Galileo, Descartes, Newton, Fermat, Leibnitz, Laplace, Gauss, Hermite, Lie and many others. For the reader with a more mathematical background, Carl B. Boyer presents "THE HISTORY OF THE CALCULUS AND ITS CONCEPTUAL DEVELOPMENT". This 346-page book presents a detailed picture of the development of one of the most momentous achievements of human intelligence—the calculus. Beginning with Zeno's famous paradox on through the work of Arabic and scholastic thinkers, to the formulations of the 19th and 20th Century mathematicians, Dr. Boyer shows how the changed concepts of the calculus affected the methods of mathematical discovery and foundations of mathematical thought. The books are priced at $2 each and are available from Dover Publications Inc., 180 Varick St., New York 14, N.Y.

MATHEMATICAL HANDBOOK FOR SCIENTISTS AND ENGINEERS. A comprehensive collection of mathematical definitions, theorems and formulas for scientists, engineers and students. The handbook presents a survey of mathematical methods useful for general applications. Each chapter contains a review of a complete mathematical subject. Among subjects covered are algebra, analytic geometry, calculus, vector analysis, integrals, Fourier analysis, Laplace transformations, differential equations, Boolean algebra, correlation functions, numerical computation and finite-difference methods. To increase readability of the book, mathematical proofs have been omitted. Instead, references to textbook material are provided for more detailed studies. By Granino A. Korn and Theresa M. Korn; McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y.; 944 pages; $20.

HIGH-STRENGTH STEELS FOR THE MISSILE INDUSTRY stresses problems in development and application of ultrahigh-strength metals for America's missile program. The book comprises papers by 14 outstanding authors actively working with materials for aerospace requirements—papers which were presented at the symposium at the Golden Gate Metals Conference, February 4-6, 1960. Edited by H. T. Sumsion, Lockheed Missiles & Space Div., the 276-page book contains more than 200 illustrations, tables, charts and graphs. Papers included in the compilation are: "Materials and Fabrication Problems in Pressure Vessels", "Stress Corrosion of Aircraft and Missile Steels", "Fracture Theory in Pressure Vessels", "Fabrication Techniques for Rocket Motors" and "Future Applications of High-Strength Steels". American Society For Metals, Metals Park. (Novelty), Ohio; $12.

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P-K Internal-Fin Coolers can be furnished insulated with Rock Cork laid in asphalt and covered with a heavy steel jacket. Illustration shows insulated cooler.

Revere helps fit the metal to the job

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NE-2H lasts 25,000 hours on standard AC voltage,* only ¾ inch long, operates on just ⅛ watt, is a high brightness lamp and costs much less than a dime including an attached resistor (5 different resistors are available).

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**With a 30K resistor.*

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BOOKS

STRUCTURAL MECHANICS IN THE USSR, 1917-1957, is an English translation of a work edited by I. M. Rabinovich, Corresponding Member of the Academy of Sciences of the USSR and Full Member of the Academy of Structures and Architecture of the USSR. The level of research and development in structural mechanics as carried out in the Soviet Union has been both intensive and extensive. This volume discusses particularly Soviet contributions to such branches as theory of plates and shells, theories of elasticity and plasticity, and approximate methods of structural analysis. The review is divided into nine chapters, each covering a particular field of structural mechanics. Each chapter is followed by a bibliography of Soviet papers and books. Published in Moscow in 1959, it was translated by G. Herrmann with financial support of the Structural Mechanic Branch, Office of Naval Research, Department of the Navy. The 431-page volume is published by Pergamon Press Inc., 122 E. 55th St., New York 22, N.Y.; $8.

MECHANIZATION OF MOTION is developed from an experimental teaching program designed to provide undergraduate students with the basis for creative decision-making in the design of machines to control motion. It is intended to present rational procedures for the synthesis of mechanisms. A combination of the fundamentals of kinematics, the techniques of ideation and new techniques of analysis is given in a step-by-step discussion of logical procedures for synthesizing mechanical systems. Technical content is organized to develop a rational process for creative, unique solutions to realistic engineering problems in the mechanization of motion. A choice of possible solutions is shown for each design situation. In Section One, Lee Harrisberger provides the means to establish a creative attitude. Ideation and brainstorming exercises discussed have proved to be an important contribution to the development of the creative approach to design. The section also discusses elements of mechanisms and reviews the elements of motion. Section Two introduces the theory of rolling and sliding contact and involutometry. Section Three gives a new approach to programming nonuniform motion. The technique of graphical integration has been adapted to construction and analysis of displacement, velocity and acceleration diagrams. Major chapters each contain a technical appendix of specialized information as reference material. Also, a bibliography has been compiled for each area. John Wiley & Sons, Inc., 440 Park Ave. S., New York 16, N.Y.; 363 pages; $8.50.

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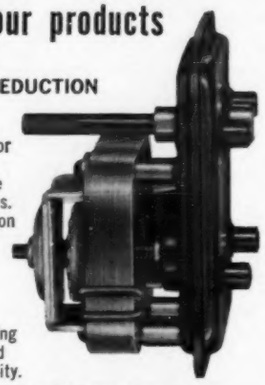

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MODEL 205	Intermittent	Continuous
SPEED	13 RPM	13 RPM
TORQUE	150 in./oz.	100 in./oz.
AMPS, No Load	2.5	1.25
WATTS, No Load	26	13
REVERSIBLE	No	No
CONDENSER	None	None
MODEL 306	Intermittent	Continuous
SPEED	13 RPM	13 RPM
TORQUE	200 in./oz.	75 in./oz.
AMPS, No Load	1.2	0.4
WATTS, No Load	25	7
REVERSIBLE	Yes	Yes
CONDENSER	60 MFD	25 MFD

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PRINCIPLES OF MANUFACTURING MATERIALS AND PROCESSES points out basic principles involved and bases its approach on these principles. The book proposes to advance the reader's ability in problem solving, stimulate his creative thinking and present a challenge. Chief objective is the education of engineering undergraduate students. However, the text is also a valuable reference book for engineers in manufacturing and design. James S. Campbell, Jr.; McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y.; 674 pages; $9.75.

DEFENSE PROCUREMENT AND SMALL BUSINESS reports on the results of a survey by the College of Business Administration of the University of Washington. Sponsored by the Aerospace Industries Association, the 135 pages are filled with statistical data and analysis of the selling and bidding practices of small business in the United States. To sell their own products, more than 90 percent of the respondents to the questionnaire prefer the negotiated bidding method to the advertised bidding method. The respondents generally favor the government's use of advertised bidding for such "nonweapon" products as fuel, office supplies, uniforms and barracks. The 37 tabulations and the text analyze the answers to questionnaires in an academic but readable manner. Engineering managers concerned with safeguarding their "proprietary rights-in-data" will find the survey report both interesting and consoling. The practices and opinions of the 1,165 small businesses which responded to the questionnaire are fruitful reading for both procurement officials and contractors concerned with the economic policies of the Department of Defense. Author, Albert N. Schrieber, et al. Distributed by University of Washington Press, Seattle 5, Washington; $3.75.

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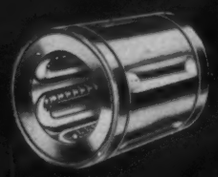

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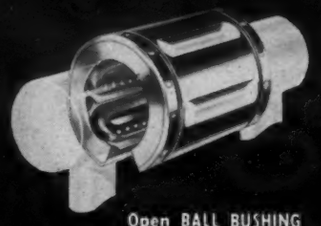

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Consult Acme's Engineering Department for assistance in selecting the proper chain for your installation. By taking into consideration such factors as horsepower to be transmitted, size and speed of shaft, space limitations, etc. this will determine the standard size of chain required to do the job best. This size or any other can be obtained off-the-shelf from your local Industrial Distributor.

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DESIGN IDEAS IN THE NEWS

Piezoelectric Pickup Reveals Stress History of Metal Specimens

MUNICH, GERMANY—A new piezoelectric device records mechanical vibrations generated within specimens during deformation. Vibration pulse frequency is time-averaged electronically and plotted together with a stress-strain diagram to show whether specimen is virgin or has previous history of deformation.

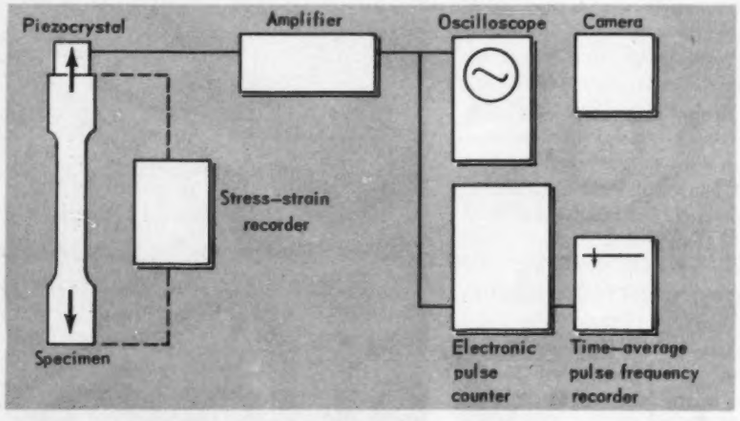
Specimen is cut carefully from sample to preserve internal stress pattern. As metal deforms, individual sections of crystal lattice move relative to each other along slip planes. Motion is uneven as sections slip, lock and slip again. Roughness of motion, leading to mechanical vibrations, is characteristic function of material composition and previous stress history of specimen. For tin, vibrations are in audible range and are known as "tin cry"; for other metals, electronic transformation is needed to record vibrations and interpret result.

If specimen has previously undergone mechanical stress, resulting changes in shape and magnitude of impulse frequency curve permit determination of previous stress with 5-10 percent accuracy. Characteristic change in shape of pulse frequency curve is known as "Kaiser effect"; application in materials testing field is covered by German Patent 852,771.

In typical application, masses up to 40 tons were hurled at speeds up to 50 mph against steel guard rails. While resulting rail deflection normally would have caused plastic deformation, extremely short duration of impact left rails apparently still in elastic range. To corroborate evidence of high-speed film camera, specimens were analyzed by new device and showed characteristic pattern of undeformed steel which proved adequacy of guard rails.

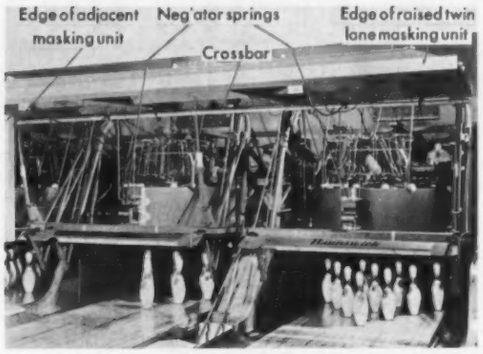
The new method was developed in the Institute of Metallurgy of the Technische Hochschule, Munich.

R. F. S.



BLOCK DIAGRAM shows specimen under tensile stress. Piezocrystal, glued to one end, acts as transducer, converts mechanical vibrations of specimen into electrical pulses. Matched amplifier has gain factor of about 3 x 104 and high input impedance to minimize phase distortion. Amplified pulses are displayed on oscilloscope and recorded by camera with continuous film feed. Counter forms time average of pulses, which is registered as function of time by electronic compensating recorder.

Constant-Rate Springs Position Pin Setter Cover



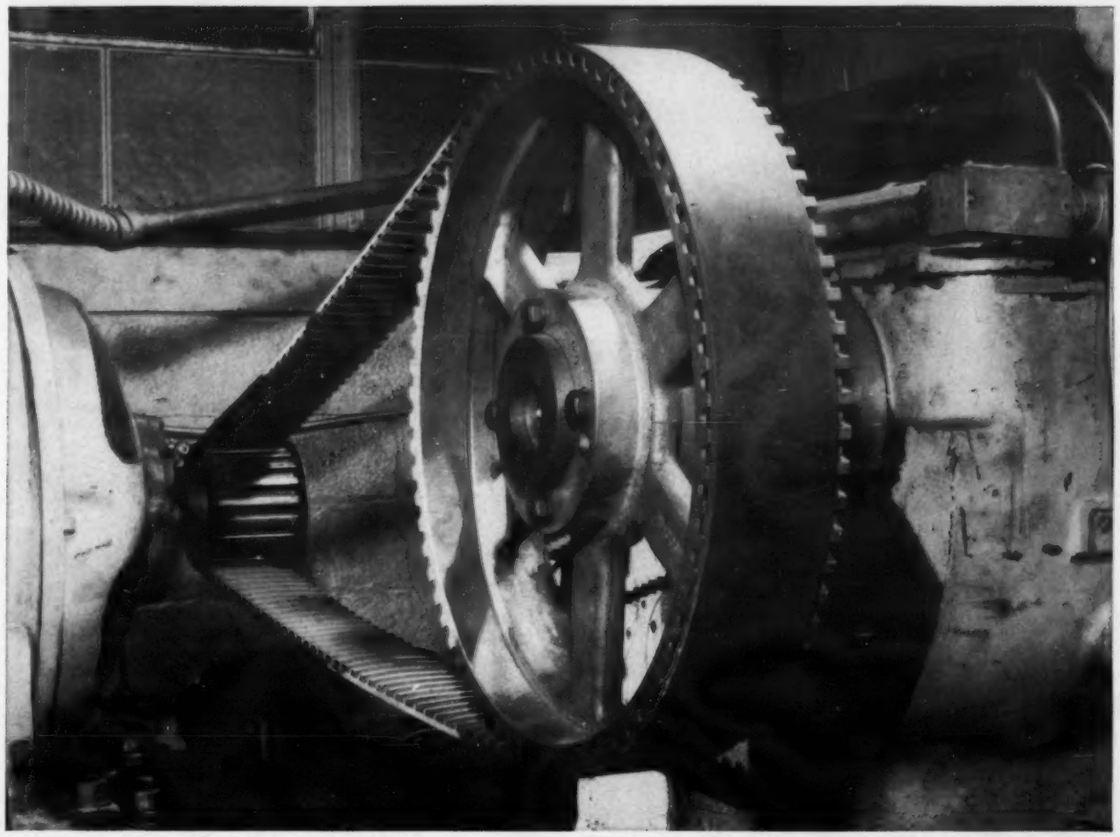
MACHINE COVER, shown in "up" position, pivots about horizontal crossbar for machine service. Cover weighs approximately 120 lb and masks two machines. Two balance springs each exert 55-lb pull through 15-inch extension. Fixed ends of springs are coiled on bushings mounted to pin-setter frame. Hook formed in spring free ends engages hairpin rods fastened to top of cover.

LANSDALE, Pa.—A constant-force, coiled band spring is the counterbalance for a horizontal pivot cover of an automatic bowling pin-setting machine. Effort required to lift cover is reduced. Positive stop for "up" position is not required. Cover is retained by stop built into spring.

The masking cover balance mechanism is applied to the Brunswick Automatic Pin Setter. Constant force "Neg'ator" springs were manufactured by the Hunter Spring Co., Div. of American Machine & Metals, Inc.

E. J. S.

➧COVER IN VERTICAL CLOSED POSITION overbalances spring force. When raised manually to within 15 deg of horizontal, spring force overbalances cover load, pulling it to horizontal position. Free end of spring is "dead" and is not prestressed. Dead-end acts as stop. Spring will not coil beyond this point. This establishes masking cover in horizontal "up" position. Full 55 lb-per-spring force is still available to hold cover in this "up" position.



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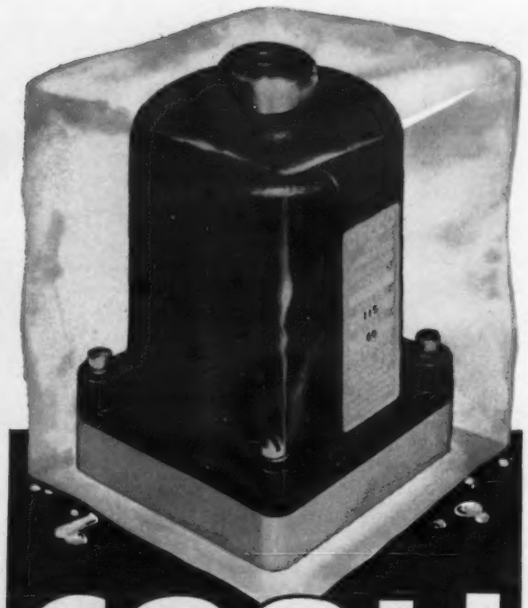

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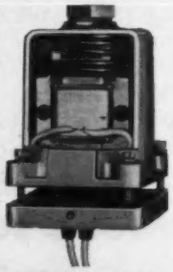

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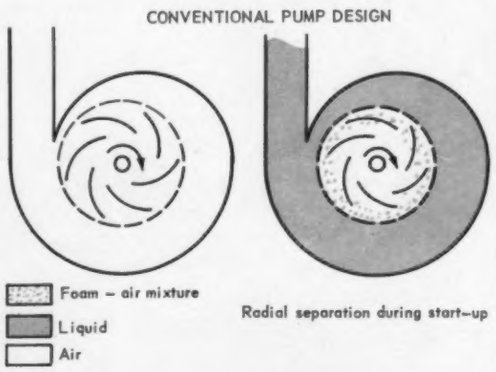
IDEAS IN THE NEWS

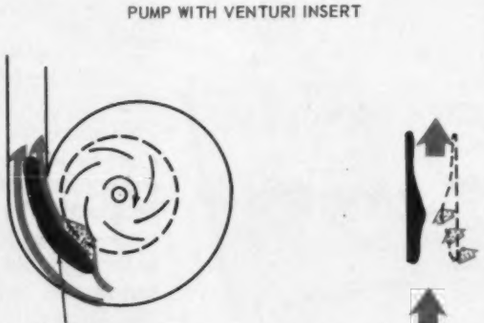


SEPARATION of contents under centrifugal action into peripheral liquid, concentric foam and air zones.

• **STATIONARY INSERTS,** similar to one-half of a venturi nozzle, remove foam from the center of a centrifugal pump during startup. In conventional pumps, centrifugal action forces the liquid towards the periphery, leaving concentric zones of foam and air toward the center. Venturi insert causes part of the peripheral liquid to accelerate and entrain foam.

During subsequent deceleration, foam bubbles are partly collapsed and leave the pump together with peripheral liquid. Continued entrainment of foam gradually removes air from casing until pump reaches normal liquid-filled operating condition. Absence of moving parts in self-priming insert eliminates maintenance. The patented design is a product of Hannibal-Pumpenfabrik, Duesseldorf, Germany.

R.F.S.



VENTURI INSERT diverts part of peripheral liquid into rotor space, where it entrains foam. Returning to stationary pump space, liquid and foam are mixed and decelerated. Arrangement is equivalent to one-half of a venturi nozzle. Sketch shows peripheral liquid entering at high speed and pulling in foam from side; liquid-foam mixture leaves after deceleration.

New Stock Molded Knobs

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4 Standard Sizes

Meet MIL-P-14 Specs

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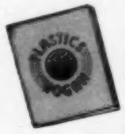

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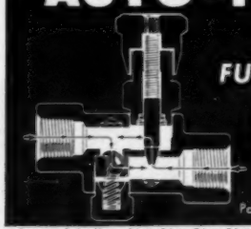

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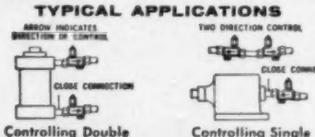
Model PF Knob and Dial Flow Control Valve or Model PN Needle Valve for panel mounting.
Model C Check Valve for In-Line Mounting.

TYPICAL APPLICATIONS



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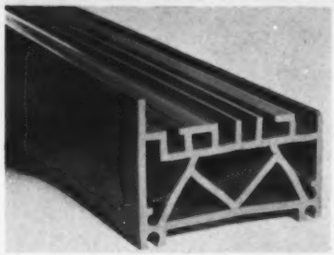


SIX-HOLLOW SECTION forms sill of prime window which is fabricated completely of extruded rigid vinyl. Section is designed to increase rigidity of material to provide flexural and torsional properties equivalent to window components made of light-gage metals.

• **AN ARCHITECTURAL** development is the fabrication of window sash and frame assemblies entirely of extruded "Geon", a rigid vinyl material. Extruded sections are fabricated by cutting to size and assembling by solvent or heat welding. Among the advantages resulting from this method of manufacture are better thermal barrier properties, improved resistance to weathering and corrosion, lower initial costs and reduced maintenance.

One of the primary considerations in designing the window was the low modulus of elasticity of this material. Flexural and torsional stiffness must be comparable to that of window assemblies fabricated of more conventional materials. This was accomplished by designing the extrusions with multiple hollows, providing higher moments of inertia than that of a hollow rectangular section.

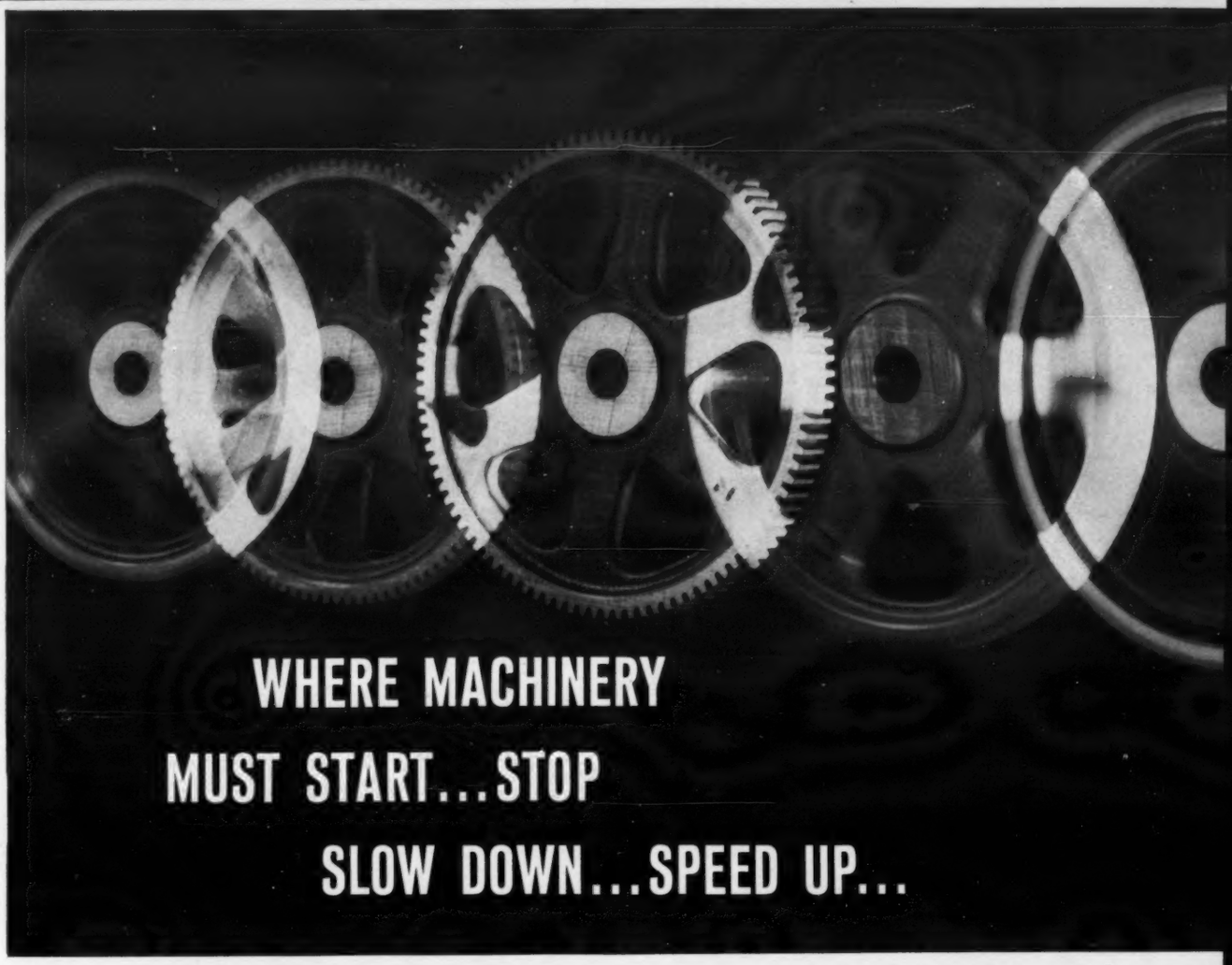
An additional consideration was the material's high coefficient of expansion. This was overcome by designing expansion joints in the extrusions which allow the window assembly to adjust to temperature conditions. It also provides a simple adjustment of the window frame to openings which may be out of square.

The window has been submitted for FHA approval.

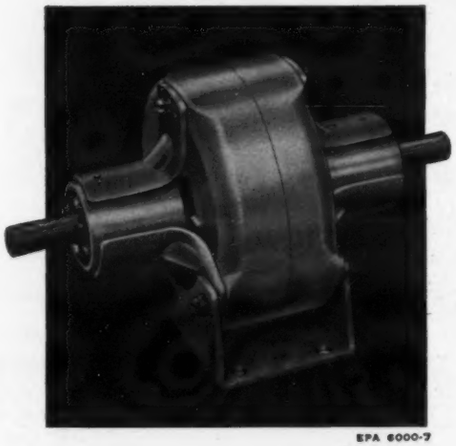
Crane Plastics, Inc., Columbus, Ohio, developed the window in cooperation with the Goodrich Chemical Co., Cleveland, Ohio, for a European manufacturer.

E.J.S.

Circle 145 on Reader-Service Card



The Smoother Operating Vickers MAGNECLUTCH® Adds Longer Life and Greater Reliability



EPA 6000-7

Start . . . stop. Fast . . . slow. High slip . . . low slip. These conditions drive most clutches to early graves. They can't take the stresses and strains of no-speed low-speed high-speed in merciless repetitive cycles.

Now see how the Vickers MAGNECLUTCH meets this problem: There is no mechanical contact between rotating members. Torque is transmitted by the linking action of energized ferro-magnetic particles, and is independent of speed. Torque is a direct function of the clutch current. From stop to full speed, torque is transmitted in a smooth curve, without grab or chatter. *There is no stress or strain.* Result: the clutch is more reliable, lasts longer. Standard MAGNECLUTCHES (and MAGNEBRAKES) available from 11 oz.-in. to 600 lb.-ft.

Contact the Vickers field engineer in your area for complete information, or write for Bulletin Series 6000.

VICKERS INCORPORATED
Division of Sperry Rand Corporation
ELECTRIC PRODUCTS DIVISION
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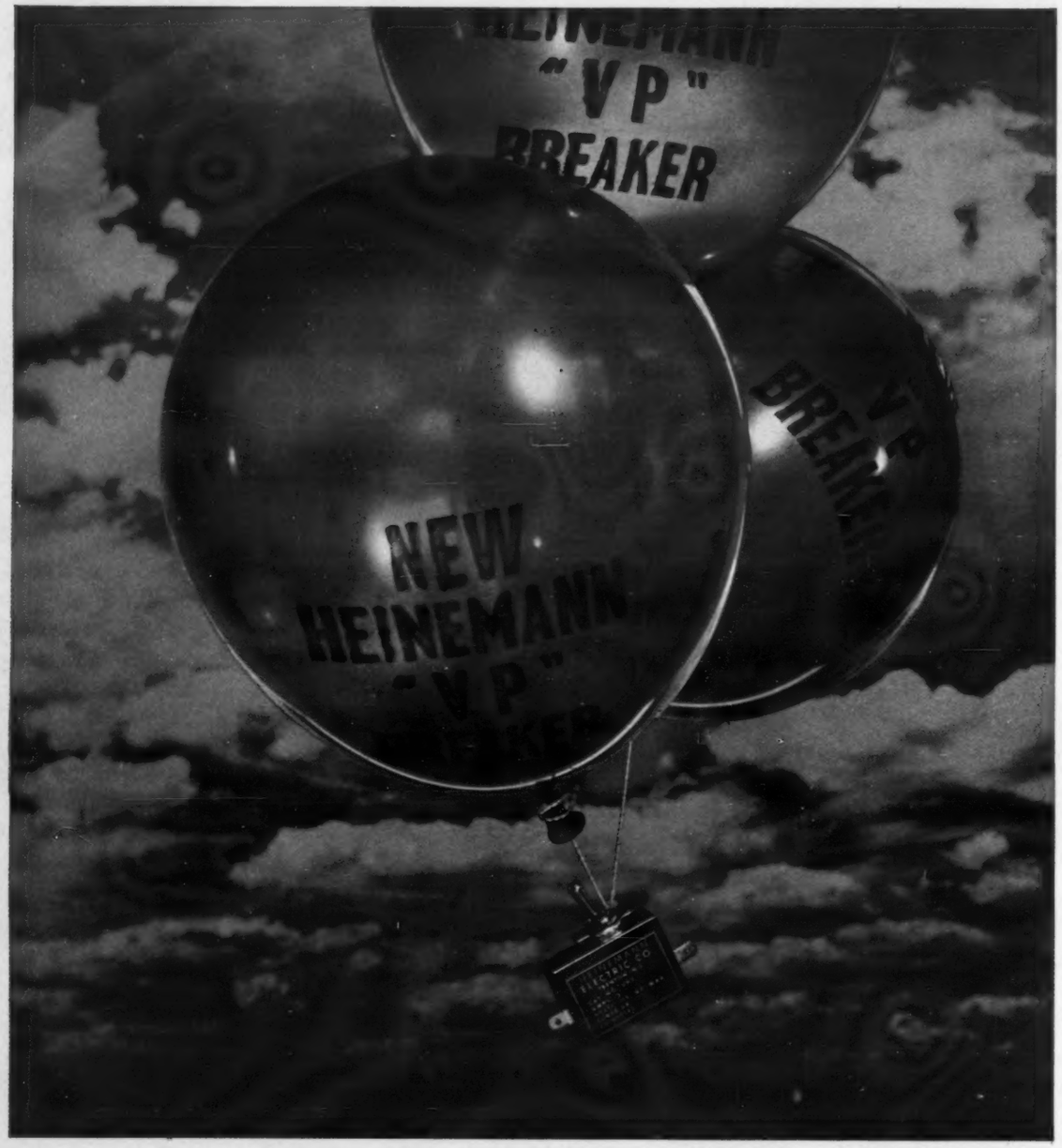


Only 1-1/2 ounces (including the switch plate)

Heinemann's new Series VP may well be the lightest circuit breaker made. For sure, it's one of the smallest and most compact you'll find around. Yet, remarkably, it's capable of handling all the functions of much larger Heinemann breakers.

It is temperature-stable. Current rating and calibrated trip-points are completely unaffected by ambient temperature. No derating . . . ever.

It is available with a choice of time relays. You can have either a "fast" or "slow" delay. Or instantaneous response.

It can be furnished with any of Heinemann's special-function internal circuits. With a little ingenuity and a special circuit, you can make the breaker do such out-of-the-ordinary chores as remote switching, circuit "slaving," alarm signaling.

The matchbox-size Series VP is available in any integral or fractional rating you might need, from 0.050 to 15 amps (at 110V, 60 or 400 cycles AC, or 50V DC).

Bulletin VP will give you detailed specifications and dimensions. A copy is yours for the asking.

HEINEMANN ELECTRIC COMPANY ◆ 105 BRUNSWICK PIKE, TRENTON 2, N. J.

SA 2450

Circle 146 on Reader-Service Card for more information

IDEAS IN THE NEWS

• **AIR HOUSES** lower storage costs by as much as 80 percent for the B. F. Goodrich Co.

The two air warehouse constructions, believed to be the first to go into service in the western states, as multiple units are standing side by side on a former car-parking area in the Los Angeles central manufacturing district. They provide warehouse space for 60,000 passenger tires.

Each structure, containing 226,195 cu ft and measuring 180 ft long, 60 ft wide and 30 ft high, is shaped like a quonset hut with round ends. Both units were erected and ready for service in only two days.

A 3-hp electric motor with 30-inch fan runs 24 hr per day to keep each structure rigidly inflated at 1/2 lb of pressure per sq ft. In case of electric power failure, an auxiliary gasoline engine is activated to maintain the same pressure.

The air buildings were manufactured by CID Air Structures Co., Chicago, Ill. The inflatable airtight and watertight material is 6-1/4-oz nylon fabric coated with "Geon" vinyl resin, supplied by B. F. Goodrich Chemical Co. The fabric for each structure, rolled into a bundle for shipment to the site, was only 10 ft long by 4 ft in dia and weighed about 3000 lb. Each building provides 10,027 sq ft of floor space.

Each structure was inflated in just 20 minutes. Deflation can be accomplished in about 10 minutes.

• **OUTER SPACE** itself is the best laboratory for testing the design and materials for spacecraft despite great advances in environmental test equipment.

This is the view of scientists at Ford Motor Co.'s Aeronutronic Div., Newport Beach, Calif., who are conducting studies of semirigid and nonrigid manned space structures for extreme-altitude Air Force weapon systems.

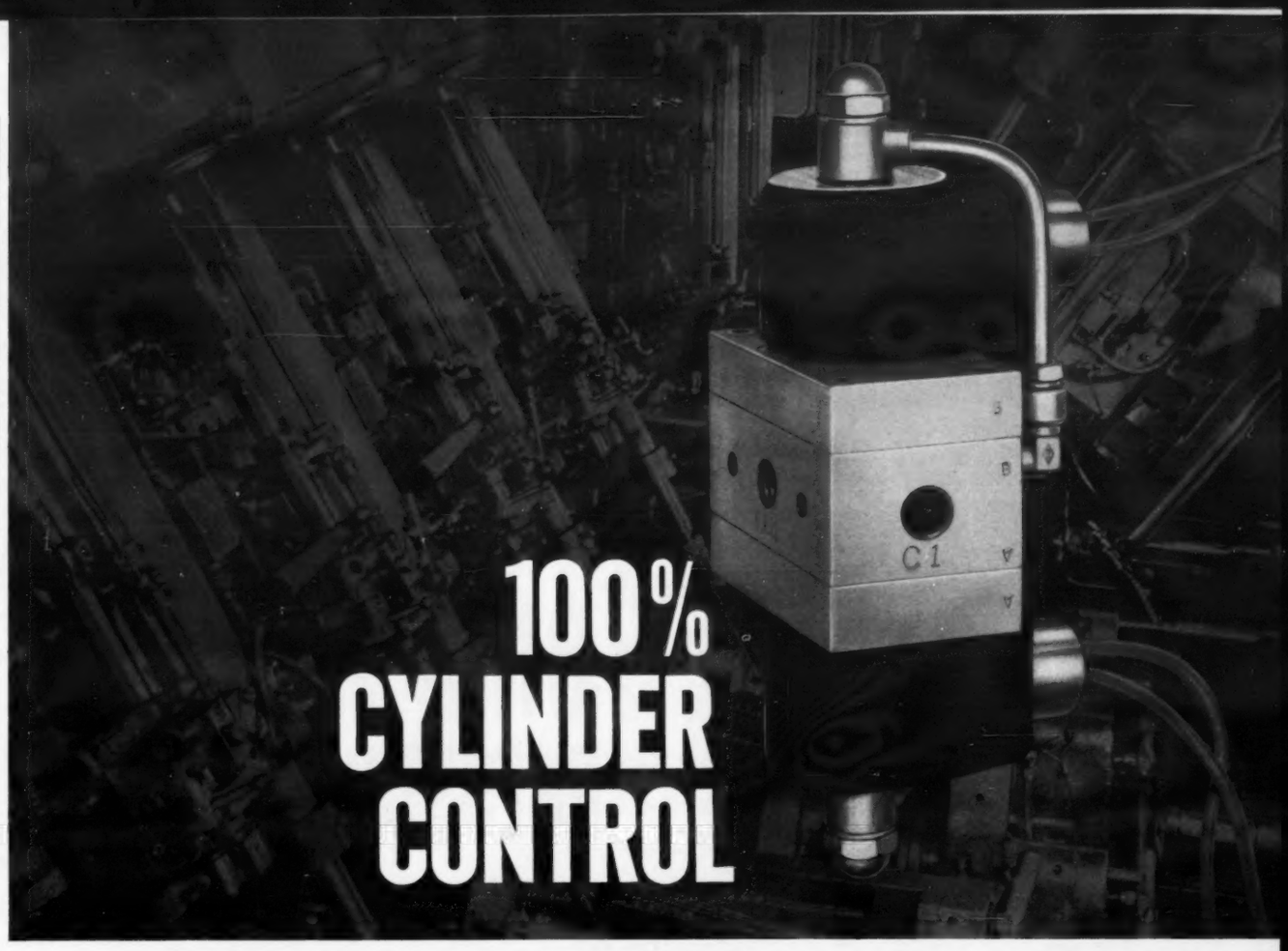
The project is a joint effort by scientists of Aeronutronic's Research Laboratories and of its Space Systems Operations.

Dr. George J. Mills, manager of the Research Laboratories Materials Dept., said the Aeronutronic studies are solving many of the problems, but that they are also leading to new problems which challenge materials technology.

The scientists are studying various modular concepts for space structures. A typical spacecraft might consist of a command post or cab up front—a highly secure, rigid structure capable of re-entry. In the center would be a propulsion component containing power for orbital correction or abort, and having a retrothrust rocket for de-orbit and re-entry. In back would be a living shelter or laboratory structure, packaged within a van module for deployment once in space.

Three general structure concepts are being studied for such a "space train". They are pressure-stabilized membrane structures, rigid-panel inflatable structures or "space shingles" and telescoping modules. The space shingle concept involves use of panels—curved or flat, interlocking or overlapping—which can supplement flimsy membrane structures and provide necessary armor within a variety of configurations. Sealing of the panels is a problem here.

Circle 147 on Reader-Service Card



DEAD-TIGHT SEATING OF ASCO 4-WAY SOLENOID VALVE PREVENTS PISTON DRIFT ...PERMITS PRECISION INCHING

3-POSITION, 4-WAY DESIGN

POPPET-TYPE SEATING— CANNOT STICK OR LEAK

INSTANTANEOUS OPERATION

EXPLOSION-PROOF ENCLOSURE AVAILABLE

PRESSURES UP TO 250 PSI ON AIR, WATER OR OIL

RUGGED BRASS BAR STOCK

2 SOLENOID CORES AND 4 DIAPHRAGMS ARE ONLY MOVING PARTS

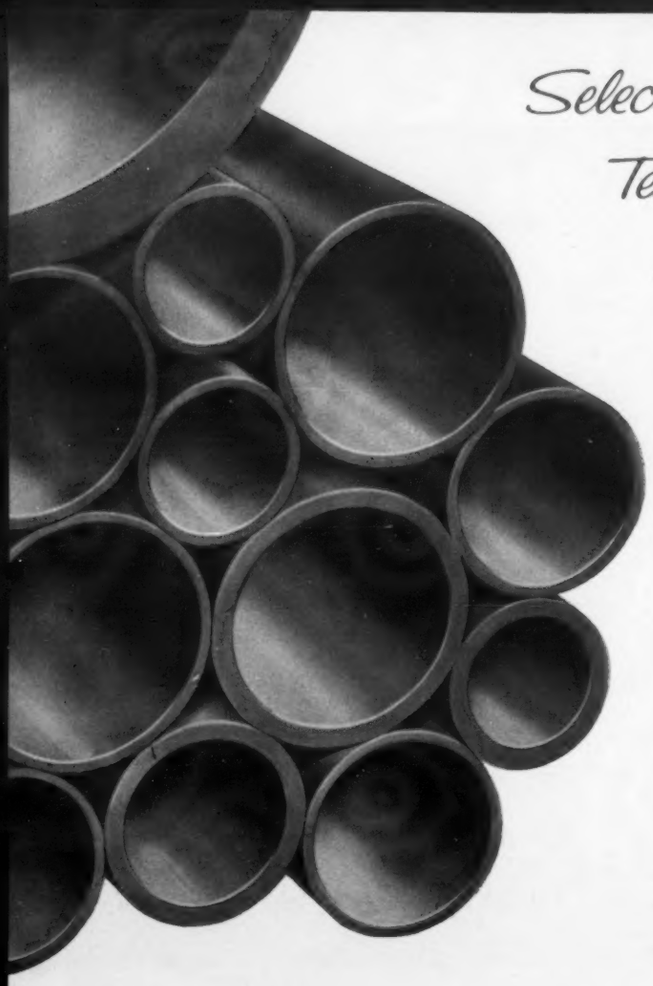
Positive control of the cylinder piston is inherent in the design of this ASCO Bulletin 8347 valve. Leakage of air or liquid is made impossible, so that whenever both solenoids are de-energized, the valve assumes a center position and all orifices are blocked, locking cylinder piston in position. Dead-tight (poppet-type) valve seating permits precision inching of the piston, as well as absolute control of any length of stroke, with instantaneous stopping and not a trace of drift.

The utter simplicity of design and rugged construction assure many millions of trouble-free operations. You can choose the 8347 in either the ¼" or the ⅜" pipe size for pressures to 250 psi, and you can mount it in any position. It is available from stock for immediate delivery, as are other ASCO solenoid valves.

Write for Bulletin 8347, providing complete descriptive information on this new, reliable 4-way.

ASCO Valves ASCO

DEPENDABLE CONTROL BY Automatic Switch Co. 50D HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • *AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL*



Selection of finest raw materials

Testing every step of the way

Inspection to rigid standards

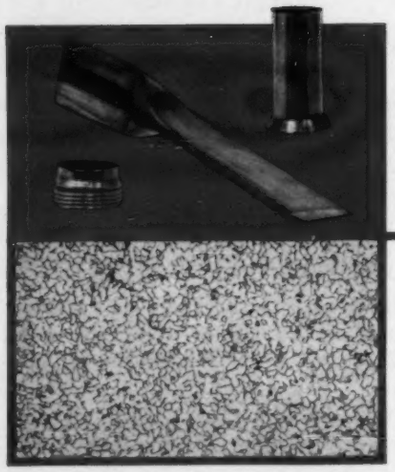
Assure 100% dependability for

OHIO WELDED PRESSURE TUBING

You can be sure — doubly sure — of utmost tubing dependability when you specify Ohio Welded Pressure Tubing — *made by Ohio Seamless.* First, Ohio works to accepted industry standards — ASTM, ASME, and similar Federal and military specifications covering welded pressure tubing. Second, Ohio Welded Pressure Tubing is produced under a *continuous* process of quality control — not just a final test inspection to cull questionable material.

Carefully selected prime raw material is slit, edged, shaped and electric resistance welded on the most versatile and modern equipment in operation. At each and every step of the way Ohio Welded Pressure Tubing is under the scrutiny of Ohio's master tubemakers . . . making control tests at frequent intervals . . . testing random samples from each production order far beyond the limits of the usage involved.

For critical pressure piping applications . . . for condensers, heat exchangers, boilers and superheaters — in the range of sizes from ½ to 7½" OD and wall thicknesses from .028 to .375"— mark your prints "*Ohio Custom Made Welded Pressure Tubing.*" There is no equivalent.



Photographs show flare, flattening and crush tests performed continuously on every order. Non-destructive tests include air, water, magnetic, eddy current and visual inspection to insure 100% dependability.

Photomicrograph of polished and acid-etched surface shows perfect microstructure of normalized Ohio Welded Pressure Tubing. Weld area running down the center is now indistinguishable and tube has become, in every sense, weldless.

OHIO

OHIO SEAMLESS TUBE

Division of Copperweld Steel Company

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Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

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A-4800A

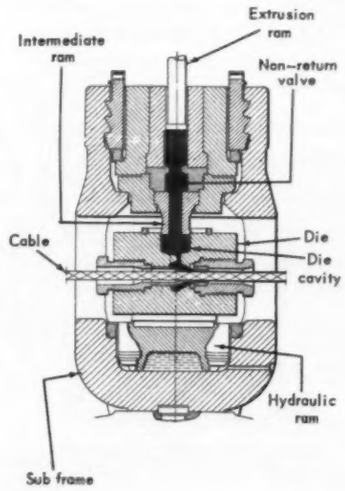
IDEAS IN THE NEWS

• **SHEATHING PRESS** enables long lengths of cable to be encased in aluminum, without the necessity of stopping periodically to insert new slugs. The press extrusion die is supported between a vertically acting hydraulic ram and an intermediate extrusion ram. This intermediate ram operates in a cylindrical cavity in the die. Its hollow center communicates with the main extrusion cylinder from which it is separated by a nonreturn valve.

In operation, during the main part of the cycle, metal is extruded by the press ram and flows past the nonreturn valve and through the intermediate ram into the sheathing die. The die bottoms on the press subframe, and the intermediate cavity is filled with metal.

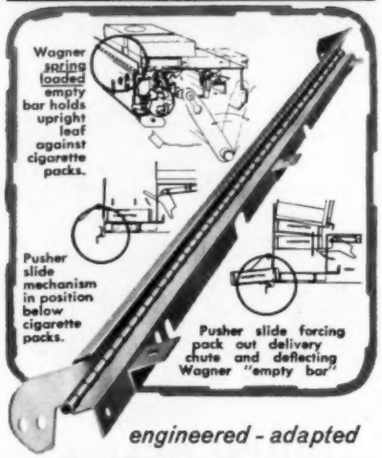
When the slug is nearly finished, high-pressure water-fed under the ram forces the die upward. As a result, the nonreturn valve closes and disconnects the main from the intermediate cylinder. The main ram then is raised and a new slug is inserted. Meanwhile, the sheathing process continues under action of the lower ram, using metal stored in the die cavity. The press is a development of Hydraulik GmbH., Duisberg, Germany.

R. W. E. M.



Circle 148 on Reader-Service Card

One CONTINUOUS HINGE saves SEEBURG 22 individual switches


Wagner spring loaded empty bar holds upright leaf against cigarette packs.
Pusher slide mechanism in position below cigarette packs.
Pusher slide forcing pack out delivery chute and deflecting Wagner "empty bar"

engineered - adapted

by Wagner

To save SEEBURG an expensive electrical assembly of 22 individual switches, Wagner engineers devised a continuous hinge "empty bar" which was connected to just two switches: 1) a coin return switch and 2) a coin deposit switch. Each column for a cigarette brand was equipped with a pusher slide at the bottom which traveled just up to the "empty bar," when a brand column was empty. When this action takes place, coins are returned. When the pusher slide moves a cigarette package against the spring-loaded empty bar, it swings forward dropping the package into the delivery chute . . . while simultaneously tripping the coin deposit switch. This "empty bar" only swings forward, not backwards, thus automatically preventing tampering fingers from reaching up to extract cigarettes. Whatever your hinging problems may be . . . bring them to Wagner . . . our engineers have the know-how and facilities to speed deliveries — produce at a savings!

Hinges for every application

write -- no obligation

E. R. WAGNER manufacturing co.
4613 N. 32nd Street
Milwaukee 9, Wis.

Wagner OF MILWAUKEE

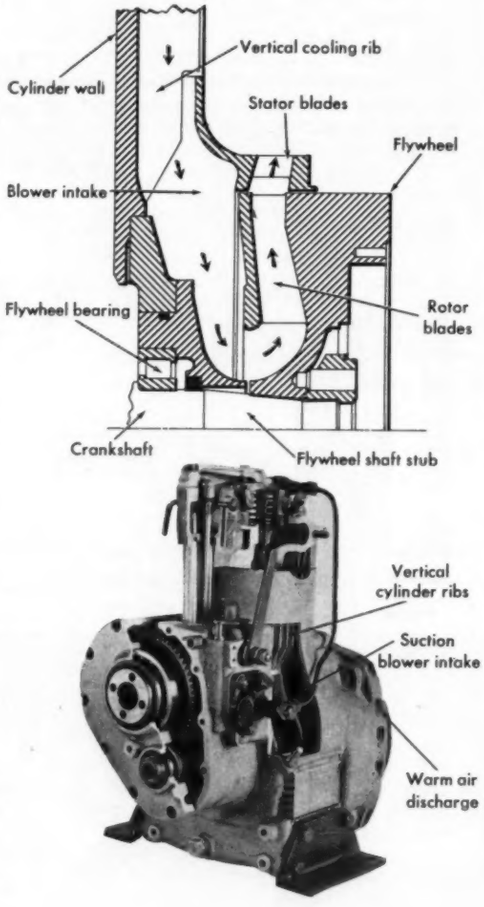
Circle 149 on Reader-Service Card

• **RADIAL BLOWER** integral with the flywheel of a small new diesel engine pulls hot air instead of pushing cold air and eliminates the diffuser usually required for efficient compression. Instead of taking in air at atmospheric pressure and compressing it slightly to force it over the cooling ribs, the new design produces a slight vacuum in the cooling area. Elimination of the diffuser cuts space requirements and weight.

Cooling ribs also depart from orthodox arrangement by being vertical and parallel to the cylinder axis. This facilitates air flow to the blower, which exhausts through peripheral ports.

Considerable improvement in cylinder head cooling is claimed. The 353-cc engine develops 3-6 hp at 1500-3000 rpm, weighs only 16 lbs/hp and is available with a variety of power takeoffs for use in construction and agricultural equipment. Type E 75 is a development of Motorenfabrik Hatz Gmbh., Ruhstorf/Rott, Germany.

R. F. S.



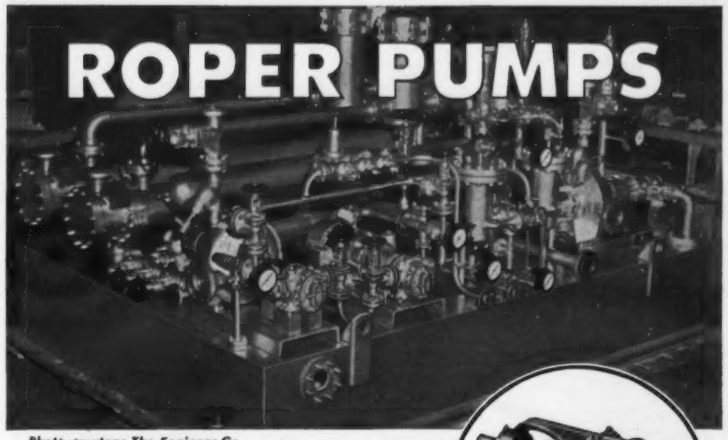


Photo courtesy The Engineer Co.

maintain lubrication of seals and oil bearings on large centrifugal compressor

• CAPACITY RANGE: 5-75 GPM • OPERATING PRESSURES: TO 1000 PSI

The complex lube system for this centrifugal compressor was designed by The Engineer Co. for the Elliott Co. and Blaw-Knox for Ashland Oil Co., using two types of Roper pumps as booster and main lube units. The Fig. 1H15 booster pumps handle 70 SSU viscosity SAE-10 lube oil at operating temperatures of 140°F, and deliver up to 17 gpm at 475 psi pressure. The two main lube pumps are specially modified Roper Series K units handling 76 gpm at 50 psi. Close cooperation with The Engineer Co. by Roper determined the pumps which would best serve the needs of this lubricating system. Special problems involving pump components for your equipment will receive this same skilled assistance by Roper engineers.

RELIABLE SERVICE AT HIGH PRESSURE

- **SPUR GEARS,** specially designed for high volume efficiency at high pressures, are hardened, ground, shaved, and perfectly balanced to operate quietly, smoothly.
- **DRIVE SHAFT,** separate from the drive gear, protects pumping gears from thrust load stress, preserving the axial hydraulic and mechanical balance of the gears.
- **ROLLER BEARINGS** and bronze wearplates are built for heavy-duty use, absorbing stress of heavy loads and continuous service. These parts are lubricated and cooled by liquid being pumped, and are easily, quickly replaced.

Contact your nearest Roper Dealer for specific pump information

Send for our new Series H catalog

ROPER HYDRAULICS, INC.

Dependable pumps since 1857
COMMERCE, GEORGIA

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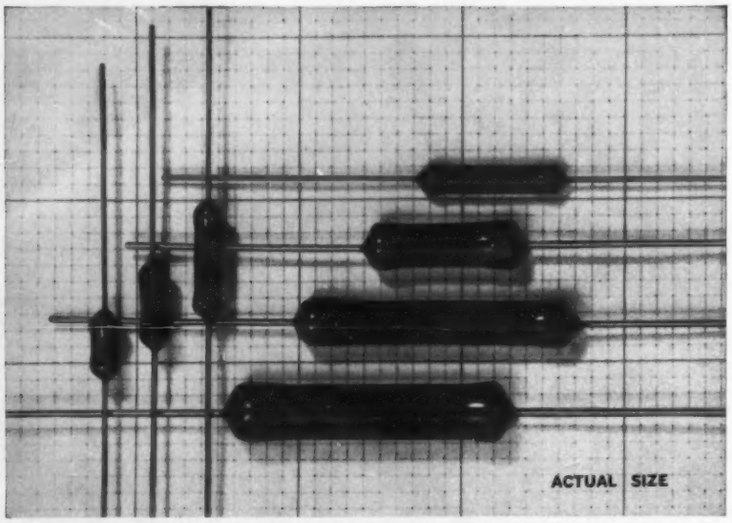


THESE "WIRE-WOUNDS" ARE CIRCUIT SHRINKERS . . . . . *newly*

expanded line lets AXIOHM® power resistors go into smaller circuits!

Ward Leonard AXIOHM power resistors are now available in *seven* sizes—down to 2 watts, up to 12.5.

They're ideal for miniaturization in printed-circuits, industrial instrumentation and automation circuitry. But they're recommended for *any* electrical or electronic application where the highest stability and maximum overload capacity are required.

The seven AXIOHM sizes come in a complete range of resistance values (see table) from 0.1 to as high as 75,000 ohms. Naturally, they feature the qualities Ward Leonard has made famous in power resistors:

Vitrohm vitreous enamel; Ward Leonard's specially made ceramic core; specially selected and matched resistance wire; and strong, permanent, low-resistance, spot-welded, lead-to-end-cap junctions. O-9

SIZES AND RATINGS

Rating (in watts)	Type	Resistances (ohms)		Dimensions (inches)	
		Min.	Max.	Length*	Diam.
2	2X	0.1	5,000	3/8	3/16
3	3X	0.1	10,000	1/2	3/16
4	4X	0.1	15,000	11/16	3/16
5	5XM	0.1	20,000	13/16	3/16
7	7X	0.1	25,000	1	3/16
10	10XM	0.1	50,000	1 3/4	3/16
12.5	12.5X	0.1	75,000	1 3/4	3/8

*Less leads.

Get complete details in Supplement C to Catalog 15. Write for your copy and a list of stocking distributors today. Ward Leonard Electric Co., 26 South Street, Mount Vernon, New York. (In Canada: Ward Leonard of Canada, Ltd., Toronto.)

RESULT-ENGINEERED CONTROLS SINCE 1892

WARD LEONARD ELECTRIC CO. MOUNT VERNON NEW YORK

RESISTORS • RHEOSTATS • RELAYS • CONTROLS • DIMMERS

See us at Booth 509 at the Wescon Show

Circle 151 on Reader-Service Card for more information

IDEAS IN THE NEWS

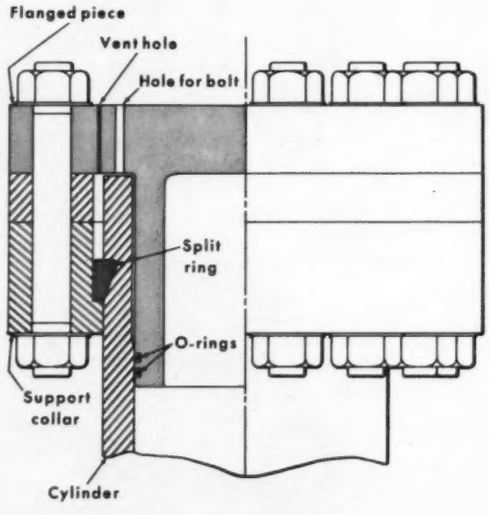
• **FLANGED-TYPE END CLOSURE,** retained by a split ring, is used in place of welding to seal an existing cylinder intended for high-pressure application. Chemical analysis of the steel used for the cylinder showed it to be of too high a carbon content for safe welding.

The split-ring arrangement, however, created another difficulty. If the vessel carried longitudinal stress and hoop tension, there would be insufficient metal available for machining the split-ring groove.

In consequence, the flanged member of the closure is provided with a skirt extending down into the vessel bore. This carries two O-rings at its inner end so that the cylinder does not carry hoop stress at any point beyond the O-rings. Arrangement allows the split-ring groove to be machined in the vessel. The position of the groove from the O-rings is such that a region of discontinued stresses is avoided. Total end thrust caused by internal pressure is carried by the split ring.

Measuring 14 ft long by 1 ft 9-1/2 inches OD with a wall thickness of 2-1/4 inches, the closed vessel has been tested hydraulically to pressures of up to 7500 psi without leakage. It was designed by the Research and Development Station of Constructors John Brown, Ltd., Leatherhead, Surrey, England.

R. W. E. M.



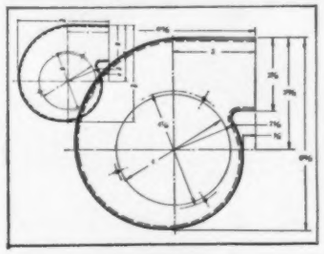
WELDLESS PRESSURE-VESSEL CLOSURE consists basically of four members: flanged end-piece, distance piece, support collar and split ring. Top end of cylinder bore is relieved to facilitate entry of skirt carrying O-rings. Bolts and flanges are lighter than normal because bolts do not have to apply gasket forces.

YOU CAN HAVE

PRE-ENGINEERING

BLOWER HOUSING

ASSEMBLIES



BUILT-IN DE-STA-CO QUALITY

QUICK DELIVERY

Long experience and tooling flexibility provide quick delivery of pre-engineered Blower Housing assemblies. Broad range of sizes and styles—in any width—available from stock dies in a matter of days . . . and no tooling costs! For special installations ask our engineers how adaptations can be made at low unit cost.

WRITE FOR FULL DETAILS AND SPECIAL BROCHURE

DETROIT STAMPING COMPANY

340 MIDLAND AVENUE · DETROIT 3, MICHIGAN

TOGGLE CLAMPS STAMPINGS

DE-STA-CO

SHIMS AND SPACERS BLOWER HOUSINGS

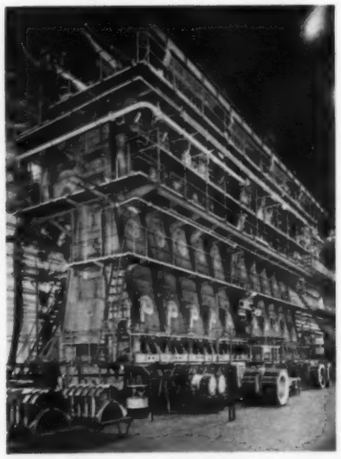
Circle 152 on Reader-Service Card

• **SUPERCHARGED, TWO-CYCLE DIESEL** reaches 140 psi indicated pressure by carefully controlling engine heat load. Improved design of exhaust turbosuperchargers, which raised total mechanical efficiency of the engine to 90 percent, and better control of gas flow during scavenging and exhaust were contributing factors.

Basic engine unit is an 840 by 1800-mm cylinder; at rated speed of 110 rpm it develops 2100 bhp. Piston is relatively short, consists of chromium-molybdenum steel and has oil cooling. Scavenging is longitudinal from equally spaced intake ports to exhaust valve centered in cylinder head. Camshaft, actuating both valves and fuel injection systems, is chain-driven. In test runs, engine has reached as much as 150 psig mean indicated pressure.

The marine diesel, type 84-VTBF-180, is made by Burmeister & Wain, Copenhagen, Denmark.

R. F. S.



WELDED DESIGN of engine housing, shown here in testshop, reduced weight from 830 tons of initial cast-iron version to 750 tons.

Circle 153 on Reader-Service Card

HOW TO MEASURE A NOISE YOU CAN'T HEAR

Vibrations detected by a sensitive pickup, then amplified and analyzed by electronic equipment, enable SKF engineers to measure almost imperceptible noises occurring in rotating ball and roller bearings. Based on long-continued investigation, noise and vibration appear to be almost solely the result of minute deviations in the surface geometry of the rolling elements and rings. Detection of this surface "waviness" as a source of bearing noise is an important SKF contribution towards solving the problem of producing quieter, smoother running bearings. Methods developed for minimizing waviness have already resulted in the quietest bearings yet made for electric motors and other equipment, as well as even greater precision in the high quality bearings for aero-space and similar applications.

Advanced research is one of the reasons why SKF maintains its leadership in producing finer rolling contact bearings. Whatever bearings you need—ball, cylindrical roller, spherical roller, tapered roller or precision miniature types – you'll find SKF your assurance of dependable performance. SKF Industries Inc., Philadelphia 32, Pa.

6102

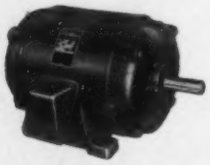
SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

Special Motors are Standard

AT PEERLESS ELECTRIC!

Need a special motor? Our knowledge may aid in reducing the engineering time. We are the exclusive supplier to many manufacturers for motors with unusual operating conditions and duty requirements. Write us your needs!



DRIP-PROOF (open type)

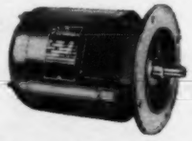
Completely protected against dripping liquids and falling particles.

TEPC and EXPLOSION-PROOF

External fan draws cool air across motor toward driven machine.

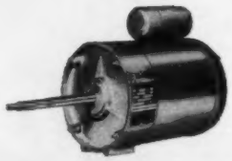
DIRECT CURRENT

High starting torque, good overload capacity and high electrical efficiency. For rough usage.



WEATHER-TIGHT SPECIAL FLANGE

EXPLOSION-PROOF TORQUE MOTOR WITH BRAKE



SPECIAL FLANGE REVERSING HOIST MOTOR, SINGLE PHASE

ENGINEERING DATA: Special mountings. Various modifications—special shaft features; paint and varnish treatments, Class A, B, F, H insulation. Peerless builds to standards and specifications of JIC, AIEE (including AIEE No. 45 Marine Duty), ABS, Federal and Military.

WRITE FOR BULLETINS: Space-Saver, SP-1; Torque, T-1; Complete Line, SDA-155. *Peerless Electric Division, H. K. Porter Company, Inc., W. Market Street, Warren, Ohio.*

PEERLESS ELECTRIC DIVISION

PORTER

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PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

Circle 154 on Reader-Service Card for more information

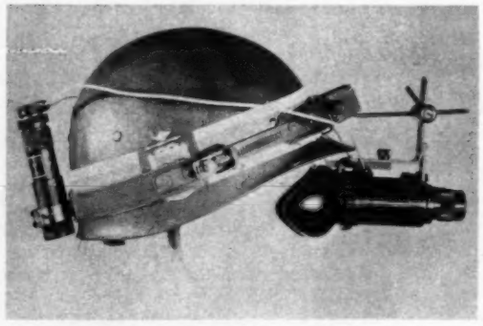
IDEAS IN THE NEWS

• **INFRARED BINOCULARS** under development by the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., placed a severe demand on the adhesive used to cement a lens element into a plastic housing.

The binoculars differ from ordinary binoculars because of the utilization of an infrared converter tube with optics, thereby permitting night viewing. The problem was to provide a perfect seal between the lens element and the plastic housing.

The seal not only must be tight against moisture penetration, but also must withstand an operating voltage across the seal of 12,000v. Before final assembly, the seal is tested at 19,000v.

The adhesive must adhere to the ground edge of the optical glass element and to the plastic which is a modified polystyrene. The seal must remain tight over the extremes of temperature required in military applications and must have enough resiliency to avoid undue strain or cracking of either the glass or plastic caused by differential expansion over these temperature extremes.



AMERICA'S MILITARY MEN will be able to see at night with the aid of infrared binoculars.

To solve this problem, American Optical Co., manufacturer of the binoculars, selected a two-part epoxy resin, J-1158, developed by the Armstrong Cork Co. Units using J-1158 withstood the 19,000v breakdown test without any failures. The adhesive was applied in the prescribed manner directly to the edge of the glass element. Care was used to prevent voids or bubbles. Two different curing cycles were tried before subjecting the seal to the electrical breakdown test—six hours at 120F and 72 hours at room temperature. Both curing cycles were satisfactory.

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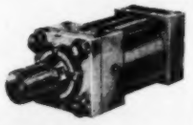
Standard Cylinders AIR or OIL Without Modification

Save money with S-P's complete line; rated 200 psi air, 500 psi oil or water; 23 mounting types; 11 bore sizes—1½" thru 14"; see Catalog 110C.

SERIES B



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Get smoother, more precise power; ruggedly built, interchangeable; 2000 psi (3000 psi non-shock); 12 bore sizes—1⅛" thru 12"; get Catalog 117.

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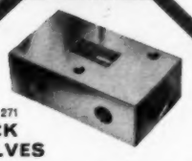
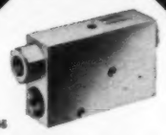
PILOT CHECK

Only 25% of line pressure required for pilot to open valve. Compact and light in weight. ¼" and ⅜" N.P.T.F., 3000 p.s.i.



Series 271
LOCK VALVES

Simple, positive, low-cost way to prevent cylinder creep due to leakage of spool valve. ¼" to ¾" N.P.T.F., 3000 p.s.i.



Series 666
COUNTERBALANCE VALVES

Smooth, positive control of negative loads. Cylinder speed proportioned to pump output. ¼" and 1" N.P.T.F., 3000 p.s.i.

Simplify hydraulic system design while you get improved performance. Why settle for halfway measures when you can specify a Waterman valve *designed* for these and other special purposes?

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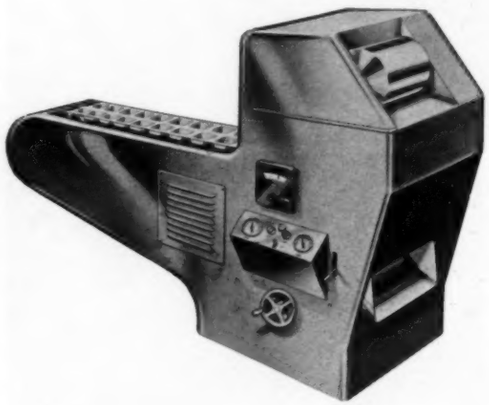
• **SINGLE MACHINE** forms a web of female blisters from thermoplastic film, into which parts are fed either manually or automatically. The strip of filled blisters is then sealed to a backing material—all in a complete, continuous operation.

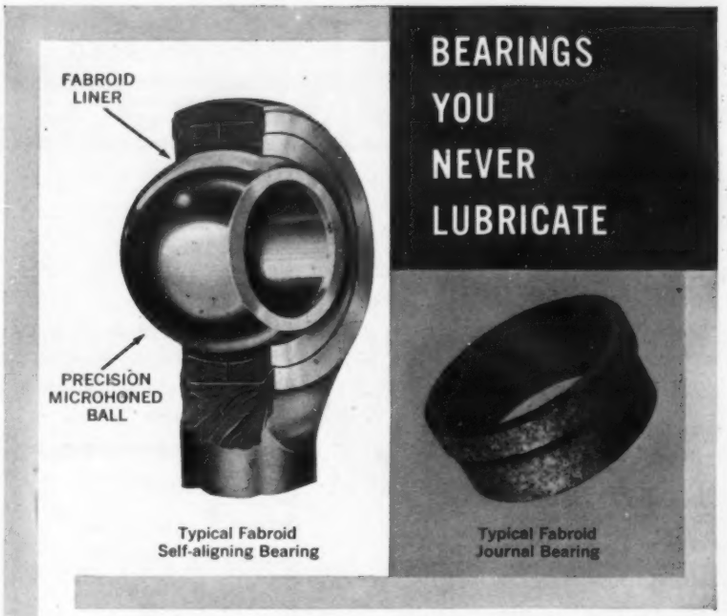
Preheating and vacuum-forming techniques permit use of almost any thermoplastic, with a choice of backing materials (roll chip, coated and uncoated, pressure-sensitive, "Kraft" or cellophane). Backing or sealing material may be printed on one or both sides; if desired.



The sealed blisters emerge from the machine in a continuous strip. Proper timing of a rotary cutoff blade permits single or multiple packages to be discharged.

Product Packaging, Culver City, Calif., designed Model 2400 especially for the electronics industry to package small, precision components. The machine is capable of speeds up to 100 blisters per minute using thermoplastic material up to 0.15 inch thick.

E. W. S.



®FABROID BEARINGS CUT FRICTION 90%

Under severe helicopter test conditions, Fabroid bearings have gone 60,000,000 cycles *without* failure where all other bearings have failed at 50,000 cycles or less. In actual use Fabroid bearings are performing equally well. Yet Fabroid bearings *never* need lubrication!

Fabroid is a combined fabric of glass and Teflon* fibers backed by glass cloth impregnated with phenolic. The glass-phenolic system acts as a honeycomb which traps the Teflon and prevents it from cold flowing. The result is a bearing with 1/10th the friction coefficient of lubricated metal bearings.

Fabroid has limitless bearing applications where any or all the following conditions exist: lubrication is impractical; extreme temperatures; tight space or weight conditions; abrading, galling or corrosion; contamination; static friction; shock vibration.

**E. I. Dupont's Tetrafluorethylene*

SEND FOR this informative brochure which fully describes the functional characteristics of Fabroid.

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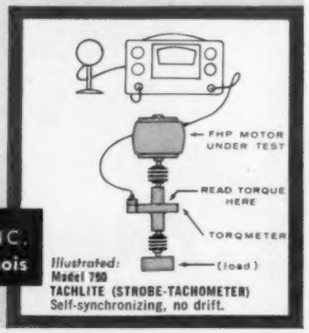
Model 783 OZ-TORQMETER
measures from .05 to 80 oz.—inch
Also available:
Model 782 GRAM-TORQMETER
measures from .25 gm-cm to 100 gm-cm
Model 784 POUND-TORQMETER
measures up to 200 lb. — inch
Model 781 GRAM-TORQMETER
measures from .05 gm-cm to 5 gm-cm



Illustrated:
Model 750
TACHLITE (STROBE-TACHOMETER)
Self-synchronizing, no drift.

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a perfect medium of
DESIGN
with functional or decorative uses

Harrington & King can perforate the proper design, pattern and open area in practically any metallic or non-metallic material available in coils, sheets or plates—from foil-thin to 1" thick. Specify H&K perforated materials on your next job.

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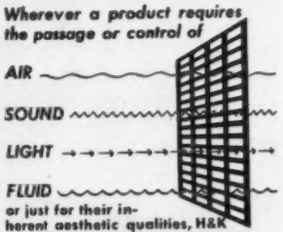

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IDEAS IN THE NEWS

• **NOVEL TRUCK CRANE** tucks in flush behind cabin, needing only 16-inch clearance between cabin and truck bed. Double-jointed U-frame crane arm contains two hydraulic cylinders which fold back the outside member on top of the middle member, then pull both alongside a short pivoting inside member. Folding controls are fully hydraulic, requiring no manual assist.

The hydraulic system is powered by an 11-hp, 600-800-rpm, 7.5-gpm, 150-atm oil pump on the take-off shaft. The standard version has 190-deg horizontal operating angle; special model has full 390-deg swivel. Load versus crane reach curve is roughly hyperbolic; average safe load moment is 36,000 ft-lb. Outside member, when fully extended, has 13-ft reach. Lift rate is 105 fpm. Crane is supported by two retractable hydraulic side pads which relieve truck frame of lateral load components. "Atlas" Type 3000 crane is manufactured by H. Weyhausen KG., Delmenhorst, Germany.

R. F. S.

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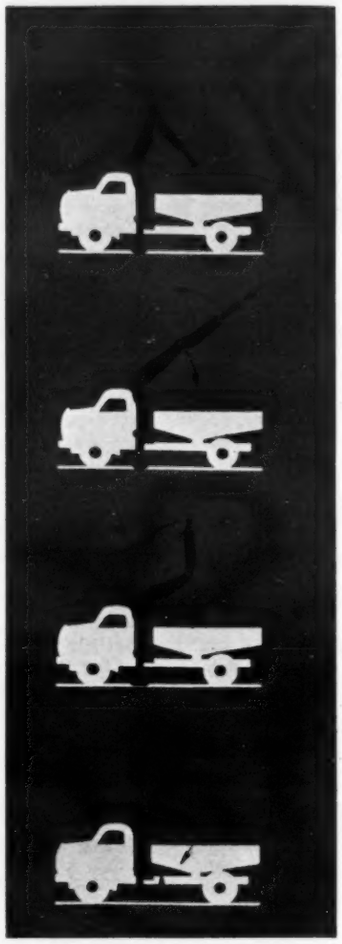
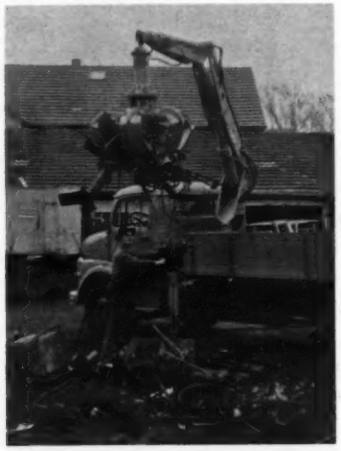


SCHEMATIC SKETCH shows crane-folding sequence.



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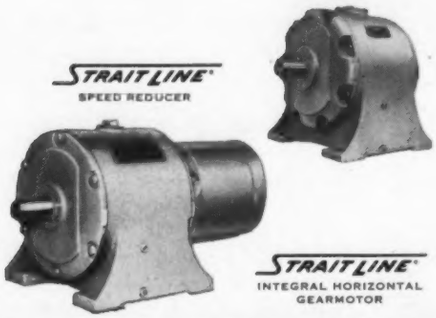

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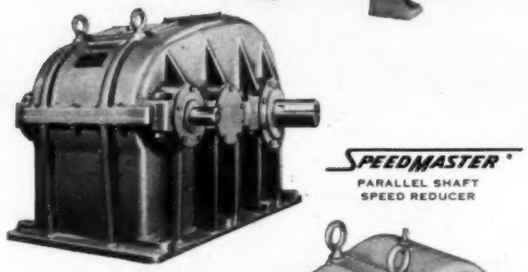

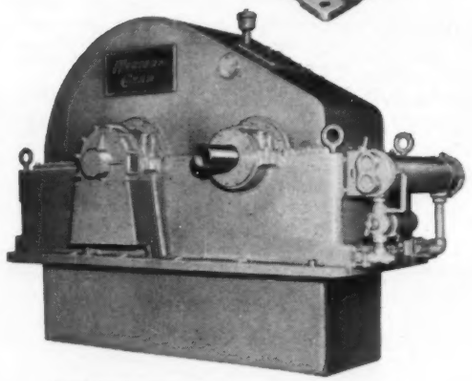

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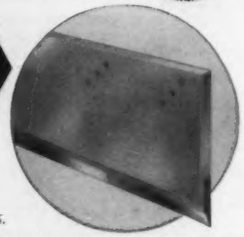

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• **CHASSIS DYNAMOMETER** on which all four wheels of the vehicle are mounted on rolls may be used either to absorb power from the vehicle or to motor the vehicle up to its maximum operating speed.

By applying appropriate loads into the power-absorbing system, performance and fuel economy tests may be made. Sound and vibration analysis may be carried on either by driving the vehicle under its own power or by motoring any combination of wheels through the dynamometer with the engine inoperative. Engine cooling and ventilation tests may be made by controlling the cooling air flow while the vehicle is operated at specific power outputs.

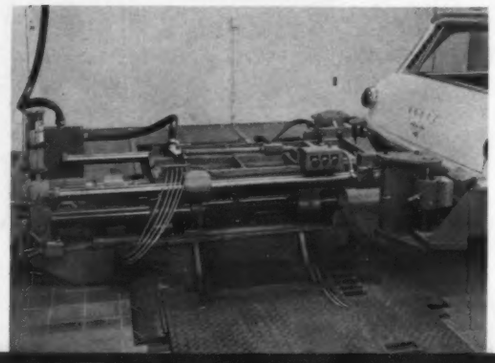
The unit is intended primarily for audit of production vehicles, for diagnosis and correction of trouble in problem vehicles and for establishment of precise historical background against which design changes may be evaluated. The installation and instrumentation are sufficiently precise for engineering research and development programs.

A d-c motoring unit plus electric power absorbers are used on each of the rear wheel rolls. Front wheels have a d-c motoring system but no absorption capability. An air blast simulating normal cooling air flow is directed on the front of the vehicle. Power output is measured by means of thrust-measuring devices fitting against the front and rear bumpers.

The four-roll dynamometer for vehicle analysis was developed by Reliance Electric Co. for Buick Motor Div. of General Motors for use in its quality and reliability programs.

K. F. K.

THRUST ABSORBERS both position car on chassis rolls and measure thrust exerted by vehicle operating against resistance of dynamometer. Thrust device is positioned against bumpers and locked in place. Ball bushings on vertical motion adjustment permit continuous contact between pads and bumpers when vertical movement is induced in car from rough roll surface. Thrust is measured by LVDT-type load cell on beam supporting thrust pads.



GRAY BIMETALLIC PIPE PROVIDES CORROSION RESISTANCE AT FRACTION OF THE COST OF SOLID ALLOY SYSTEMS

Gray Bimetallic pipe provides all the fabrication and strength advantages of carbon steel with the corrosion resistance of the best alloy materials, and at a fraction of the cost of a solid alloy system.

In the Gray process, a seamless lining is hydraulically expanded into the base pipe, forming a tight bond due to differential contraction of the materials. For all practical purposes the bond is permanent. Bimetallic pipe can then be fabricated almost as easily as carbon steel. It can be butt welded, flanged and bent without damage to the lining or the bond.

The choice of materials for Bimetallic pipe is virtually unlimited. Base material is usually standard carbon steel in regular sizes and schedules, but this can be varied to meet any particular need. Linings are most frequently furnished in Monel, nickel and stainless steel, but the selection is in no way limited. All the alloys of nickel and copper as well as the reactive metals can be economically produced.

This wide range of materials available make Bimetallic pipe ideal for all applications where corrosion is a factor. It is well suited where product contamination or catalyst poisoning are problems.

Gray Bimetallic pipe provides the corrosion resistance of special alloys at only a small cost more than that of regular carbon steel piping. For complete details, mail the coupon below today!

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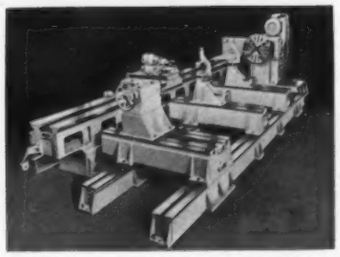


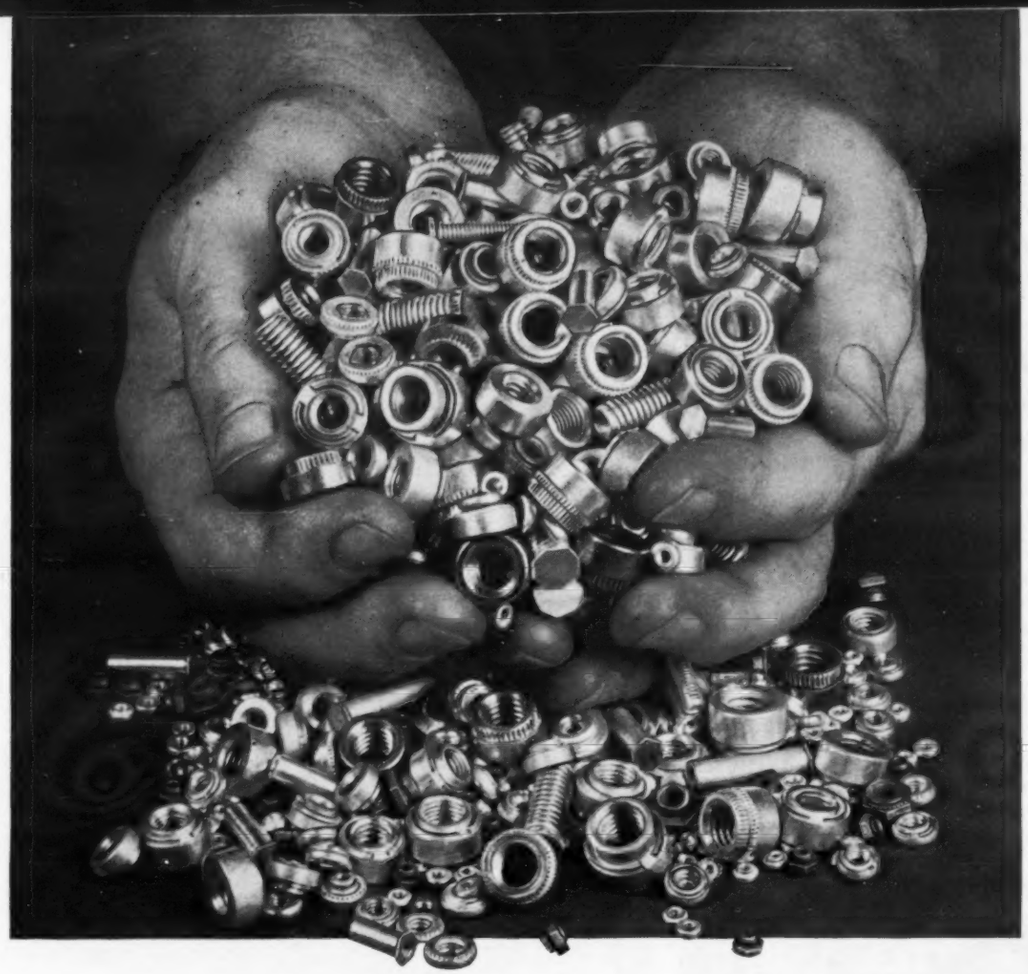
• **HEADSTOCK, TAILSTOCK AND STEADY-RESTS** of a new lathe are mounted on separate transverse slideways which in turn slide on two longitudinal beds. The lathe handles cylindrical workpieces from 4 to 71-5/8 inches in dia, with maximum chucking length of 177 inches.

A headstock for 18 spindle speeds from 12 to 600 rpm and a 10-hp pole-changing motor permit speeds down to 6 rpm. Feed and screw-cutting gearbox is separate from the headstock assembly and is attached to the lathe bed. English, metric, module and diametral pitch threads (80 of each) are provided with longitudinal and facing feeds (48 of each). Two tool carriages ride on the main bed and the top platform of each carriage rotates to accommodate multiple tool combinations.

The 10.5-ton unit was developed for requirements of the textile and paper industries where workpieces have relatively low weight but widely varying diameters. Eugen Weisser & Co. KG., Heilbronn, Germany, manufactured the unit.

R. F. S.

Circle 165 on Reader-Service Card



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You will be surprised at their economy and the added product quality they provide.

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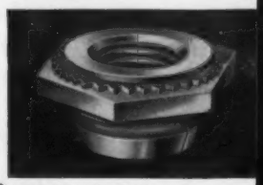
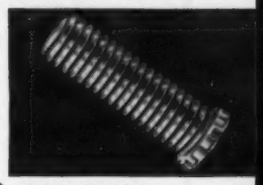


SELF-CLINCHING SELF-LOCKING NUT



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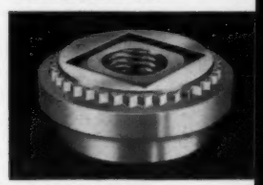
SELF-CLINCHING FLUSH FASTENER



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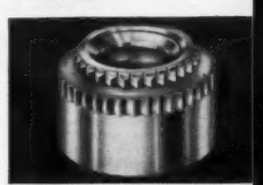
SELF-CLINCHING STAND-OFF



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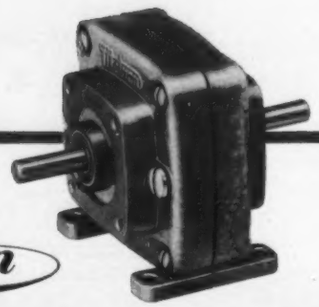
MINNEAPOLIS—GREENWOOD 4-6203
DALLAS—FLEETWOOD 7-5713
LOS ANGELES—BRADSHAW 2-8097
SAN FRANCISCO (PALO ALTO)—DAVENPORT 1-2430



FROM Metron

BANTAM SPEED CHANGERS

RATIOS: 646 from 1:1 to 85184:1
HORSEPOWER: 0.1 maximum
TORQUE: 130 oz-in
SPEED: 10,000 RPM maximum
BACKLASH: 15′ maximum (Series 11)
WEIGHT: 16 to 45 oz depending upon ratio
BEARINGS: double, heavy-duty ball
DELIVERY: 10 days

A PART OR A PACKAGE

Bantam speed changers are only one product in Metron's complete line of small speed changing components. Call on our egnineers for design help with your speed changing or control problems. Tell us what *results* you're after—what your inputs and loads are. We'll come up with an output package to do the job efficiently and economically. Send your prints today!

Metron **METRON INSTRUMENT CO.**
5310 So. Delaware, Littleton, Colo. PY 8-2537 DDD: 303 TWX: DN 194

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KLEEN-STIK®
2-SIDED *Pressure-Sensitive*
ADHESIVE FILM

Quick, Easy Bonding . . . Laminating . . . Mounting On Any Surface!

Available
in sheets or rolls ½" to 54" wide—custom-sized to your needs! Write for samples, details.

Send $1.00
for big Dispenser Pack ½" Roll! (regular $1.79 value)

KLEEN-STIK — the *modern* bonding agent — replaces and *out-performs* glues, cements, tacks, clips, staples, etc., in hundreds of manufacturing uses! Special moistureless adhesive *sticks tight* on *both sides* . . . attaches anything to anything with money-saving peel-and-press application.

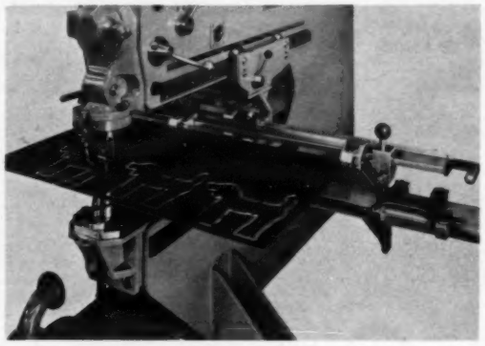
KLEEN-STIK PRODUCTS, INC.
Dept. D 7300 W. Wilson Ave. • Chicago 31, Ill.

Circle 167 on Reader-Service Card for more information

IDEAS IN THE NEWS

• **VERSATILE NIBBLING MACHINE** copies from templates, makes rectangular cuts from end stop scales, cuts circles and does other jobs such as folding, beading, flanging, slotting and cutting of ventilation louvers.

The tool bit is a tough cylindrical punch with hollow center which uses any point of its periphery as working edge. The workpiece does not have to be turned and cutting of a starting hole for center cutouts is eliminated. The tool makes from



500 to 2300 strokes per minute and is driven by a 3-hp motor. The machine can handle up to 4-mm carbon steel sheets; maximum sheet size is 1150 by 2000 mm.

No layout work on the workpiece is required. For copy nibbling, the first cutout can be positioned with different orientation alongside the template and used as an alternate template. This saves waste in case of irregular shapes. Rectangles are cut directly by coordinates measured from any two intersecting sheet edges. A separate attachment permits circular cuts from 10 to 600 mm in dia; circle centers are preset with reference to sheet coordinates.

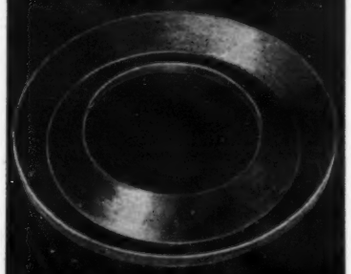
Copying and coordinate nibblers CN 63 and CN 80 (patents pending) are products of Trumpf & Co., Stuttgart-Weilimdorf, Germany.

R. F. S.

NOT JUST PACKINGS!

SPECIFY CHICAGO-ALLIS

FOR EXAMPLE VEE PACKINGS



- LEATHER—Wide variety of leathers and impregnants to accommodate a wide range of temperatures, pressures, and mediums.
- HOMOGENEOUS RUBBER—Natural and synthetic rubbers—especially compounded and processed for specific applications.
- COMPOSITION—Includes cotton and asbestos duck impregnated with synthetic rubbers, especially processed for type of fluid or medium and temperature and pressure conditions.

All Chicago-Allis packings are available with *anti-friction* impregnations or coatings.

Whether it is a problem of higher pressures, higher temperatures, extreme operating conditions, or unusual compounds or liquids . . . or just a matter of plain efficiency, economy, and dependability . . . there is a Chicago-Allis packing especially suited for the application. C-A products are used across industry . . . automotive, aircraft, home appliances, agricultural equipment, machine tools, and ordnance equipment. Just ask for the assistance of C-A engineers who are always available for counsel on your packing requirements.

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MFG. CORP.
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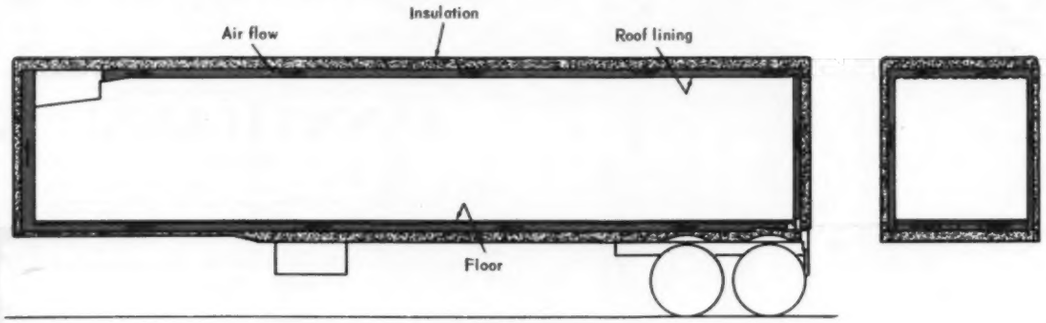
• **DUCTED COLD AIR,** forced through spaces in the roof, walls and floor of a trailer, keeps pre-frozen loads chilled. There is no air circulation through the load itself. Temperature is maintained by uniform cold air distribution around the load. Cooling action is independent of load arrangement within the van.

The perimeter cooling van is a design development of Utility Trailer Mfg. Co., City of Industry, Calif. The first van of its kind was built for Ore-Ida Potato Products, Inc., Ontario, Ore.

E. W. S.



PERIMETER COOLED VAN, unlike reefer van, maintains temperature of load at initial temperature of loading. It weighs 14,140 lb complete with inside evaporator. Load may reach from floor to roof, since cooling does not rely on air circulation through load itself. Air passageways are built into rear doors, floor and ceiling to recirculate air.

Compartments Require Locks!

CHECK THE "SPECS" ON THESE AND GET PRICES.

No. 5604

SPECIFICATIONS

3⅜ in. length of Case.
2 in. width of Case.
⅝ in. thickness of Case.
¾ in. edge of Door to c. of square hole.
5/16 in. sq. hole for Handle.
⅝ lbs. weight each.

No. 5605

SPECIFICATIONS

3" Overall Length of Case.
1" Overall Width of Case.
5/16" Overall Case Thickness.
13/32" Lock Edge (Latch Side) to Center of Square Hole.
5/16" Sq. Hole for Handle.
½" x 2⅜" Centers of Mounting Holes. ⅛ lbs. Weight each.

In addition to the 2 compartment locks shown here, Eberhard makes a line of Cabinet Hardware which will interest many designers and manufacturers.

Write for details on any or all items to:

The EBERHARD MFG. CO.
DIVISION OF THE EASTERN CO.

2702 Tennyson Rd. Cleveland 4, Ohio

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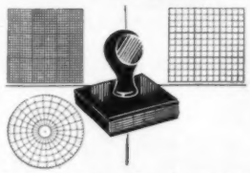
1001 USEFUL BUYS!

NEW GRAPH RUBBER STAMP KIT

Real Time and Labor Saver



Solves problem of recording graphed material neatly in engineering notebooks, reports, correspondence, etc. without using bulky sheets of graph paper. Simply stamp a clear graph pattern wherever needed. Ideal in curve tracing for loci problems in polar coordinates and transformation to polar coordinate problems from Cartesian coordinates. Use for electronic design, development and research records — plotting various curves from analytical data and math formuli—drawing curves from oscilloscope screens, etc. For all engineers, sales managers, production control. Kit includes three patterns: A—100 blocks per square inch—for plotting wave form patterns on cathode ray oscilloscopes, etc. B—¼" pattern (16 blocks per square inch) plotting in larger scale than "A". C—Polar coordinate graph stamp —3" diameter circle with major subdivisions at 15 degrees and small markings at each 5 degrees. Also large (3¼" x 6¼") ink stamp pad for use with all stamps.
Stock No. 70,475—CD . . . . . $10.00 Postpaid

GIANT INDUSTRIAL MAGNETS! MIDGET PRICE!

Recover tools and parts from inaccessible spots; hold work in place; rid shop floor of metal fragments, pins, etc. Use this horseshoe shape 5 lb. war surplus Alnico V-Type Magnet—tremendous lifting power, over 125 lbs. Rated at 2000 Gauss. Lots of fun, too—use for "fishing" the bottoms of lakes, rivers, ocean, etc.—retrieve motors, fishing tackle, metal valuables. Dimensions: A—3¼"; B—2¾"; C—4-3/16"; D—1¼"; E—1¼"; F—2⅝".
Stock No. 70,183-CD—5 lb. size . . . . . $9.95 Pstpd.
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(Order by Stock No.—Check, M. O. or Open Account—Money-back Guarantee)

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POSITIVE SEALS

−452° to 3000° F.

United Self-Energized Metallic O-Rings*...

form permanent, non-corrosive, static seals under temperature extremes from −452° to 3000° F. and pressures from 10^{-6} mm Hg to 100,000 psi. Available in various metals and coatings (including Teflon** and silver) ¼" O.D. dia. to any size and configuration. United also makes non-vented and pressure-filled O-rings. **United Metallic "O" Rings, manufactured by United Aircraft Products, Inc., Box 1035, Dayton, Ohio.**

See United Metallic O-Ring Catalog in Sweet's Product Design File or write for Free Handbook

*Patents 2,809,269; 2,837,360
**DuPont registered trademark

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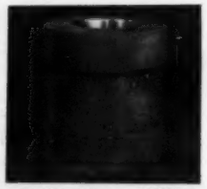
PAYS OFF UNDER PRESSURE-AMPCO® metal



Centrifugally-cast AMPCO metal screwdown nut stands up under the terrific pressures developed in rolling-mill operations.

A series of special copper-base alloys which withstands tremendous impact and shock loads — resists wear, abrasion, erosion, and corrosion. Bulletin 60 tells you more about 'the metal without an equal." Send for your free copy. Do it today.

AMPCO METAL, INC. DEPT. 40H, MILWAUKEE 1, WIS. c-s
West Coast Div.: Huntington Park, Calif. • Southwest Div.: Garland (Dallas County), Tex.

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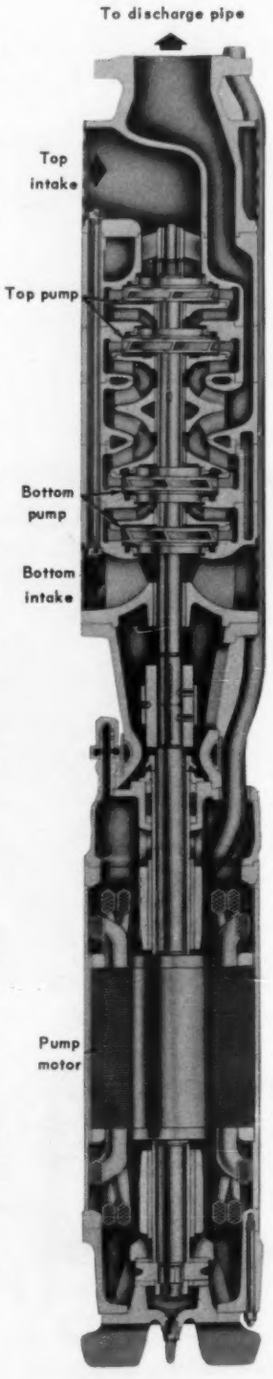
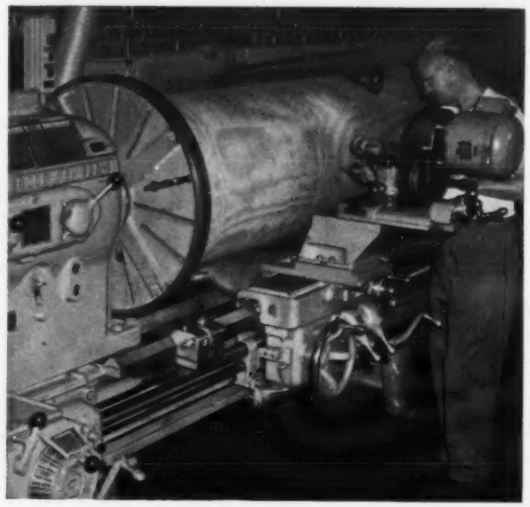
• **TWO SYMMETRICAL AND OPPOSED RADIAL PUMPS** on the same shaft balance axial thrust in a new immersion pump. Water flows through intakes at top and bottom ends of the pump assembly toward center. Main advantage compared to conventional designs is elimination of load on axial thrust bearings which in immersion pumps are water-lubricated, have limited load capacity and are difficult to maintain in sediment-bearing water.

Use of dual intakes also results in lower water velocities for the same capacity and in less mechanical strain on dirt filters. Motor is water-filled, has polyethylene-insulated windings. Available ratings in standard version range from 25 gpm (2800 rpm) to 3500 gpm (1450 rpm) with 525-ft maximum head. The pump was developed by Gebr. Ritz & Schweizer, Schwaebisch-Gmuend, Germany.

R. F. S.



1001 Ways to Machine Laminated Plastics



An Example of Synthane *You-shaped* Versatility

There are many fast, economical ways to machine laminated plastics—if you have the equipment to do the job. We have! Synthane is just about tops in U. S. for plastics fabrication. That's our business. We have all the standard tools plus many machines designed especially for the fabrication of laminated plastics. Why bother to improvise when we have what it takes to do the job—quickly and economically.

You-shaped Versatility makes Synthane a Better Buy in Laminates

SYNTHANE CORPORATION OAKS, PENNA.

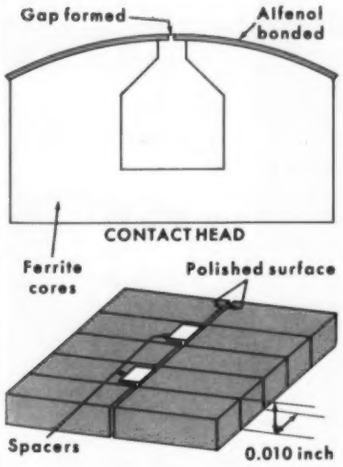
Synthane Corporation, 6 River Rd., Oaks, Pa.
Gentlemen:
Please send me information regarding the facilities of Synthane for fabricating laminated plastic.

Name_____

Address_____

City_____ Zone____ State_____

Circle 201 on Reader-Service Card for more information



• **FOR CONTACT-TYPE** recording magnetic heads, using "Alfenol" or a similar magnetic material, it is desirable to have a preformed gap, thus eliminating the necessity of lapping the gap areas prior to final assembly of the thin Alfenol strip to the ferrite core.

Ampex Corp., Video Products Co., Redwood City, Calif., has developed a technique using two Alfenol slabs of desired thickness and area. The edges of the slabs are lapped and securely butted together. Shim spacers of platinum or similar material establish the required gap dimension. The assembly then is fired with a metallic material being introduced into the gap region.

The 50-percent gold brazing allow has a fusing point in excess of the heat treatment (900C) temperature for Alfenol but lower than the melting point (1600C) of Alfenol. The brazing material introduced at the gap wets the Alfenol, is non-magnetic and is strong enough to withstand the subsequent finishing operations.

Brazing occurs at 1160C, and the assembly is then subjected to the standard heat treatment for Alfenol. The heat-treated material then may be cut into strips of the desired width and shape. Strips then are cemented to ferrite cores to complete the magnetic circuit for the recording head.

E. W. S.

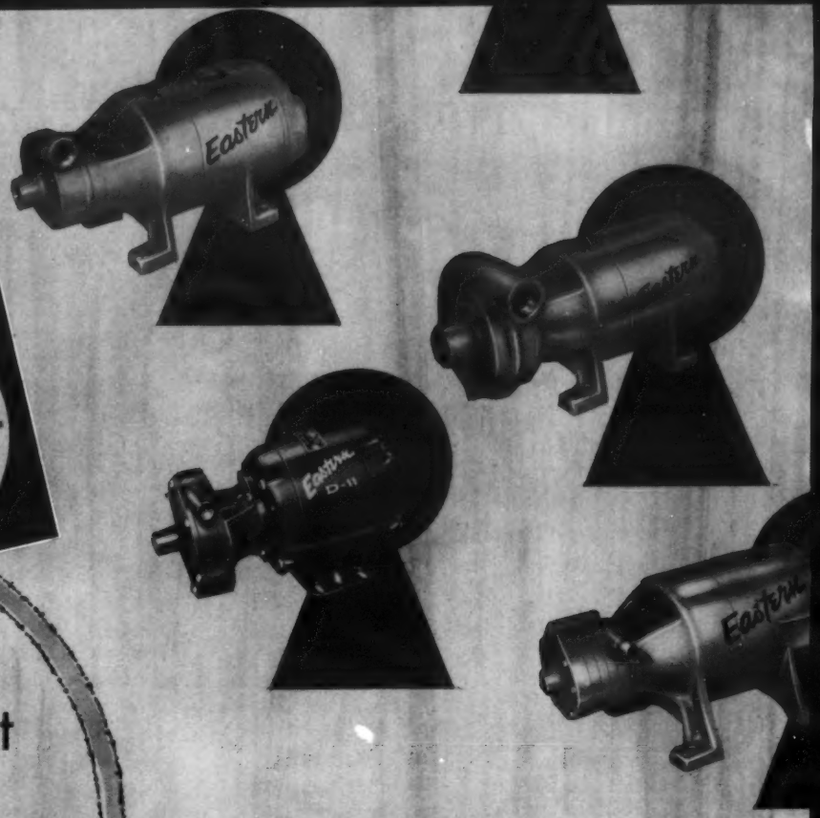
Circle 177 on Reader-Service Card

Eastern

INDUSTRIAL CENTRIFUGAL PUMPS

BULLETIN NO. 130

your key to the perfect choice of CENTRIFUGAL PUMPS



A new catalog opens wide the doors to designers of process equipment — tells all you need to know in terms of engineering data, performance charts, seals, metals, mountings!

If you need centrifugal pumps with these characteristics, this reference book is for you:

- PRESSURES: to 21 psi in single stage pumps; to 70 psi in multi-stage types.
- FLOWS: capacities to 70 gpm in single-stage pumps, to 10 gpm for multi-stage models.
- MOTORS: standard motors for 115/230 volts 60 cycles 1 phase (other electrical characteristics available). Power range from ⅛ to 1½ H.P.
- ENCLOSURES: drip-proof, totally enclosed, and explosion-proof ballbearing frames.
- DRIVES: Space-saving close coupled pumps most rugged and popular. Pedestal mounted arrangement without motor available as alternate for belt or coupling drive.
- SEALS: a variety of rotary seals and stuffing boxes, to fit every application.
- METALS: your option of cast iron, bronze, stainless steel, Monel, Cast Iron, Hastelloy "C".
- INSTALLATIONS: a wide range of transfer, recirculation, feed, boost and filter-pumping applications.

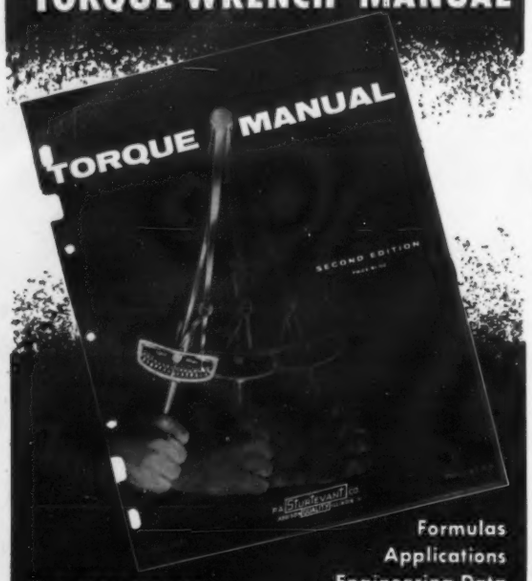
All told, 50 different models are described in full — and you get a wealth of technical data as well. Write for new catalog 130 now!

EASTERN INDUSTRIES PUMP DIVISION

EASTERN INDUSTRIES, INCORPORATED

100 SKIFF STREET, HAMDEN, CONN.
WEST COAST OFFICE 4203 Spencer St., Torrance, Calif.

"TORQUE WRENCH" MANUAL



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Formulas
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General Principles

PA STURTEVANT CO
ADDISON QUALITY ILLINOIS

Manufacturers of over 85% of the torque wrenches used in industry

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OHIO WELD NUTS

RH NUT
Thread Size #6-32 to ⅜-16

WF NUT
Thread Size #6-32 to ⅜-16

SF NUT
Thread Size ¼-13

WW NUT
Thread Size #6-32 to ⅜-16

OHIO flanged weld nuts provide extra-long thread engagement and are ideal for assemblies requiring strong primary fasteners. They can also serve as spacers or bearing surfaces where required.

Samples and information furnished upon request.

The Primary Fastener in Fastener Assemblies

THE OHIO NUT AND BOLT CO.
29 FIRST STREET BEREA, OHIO

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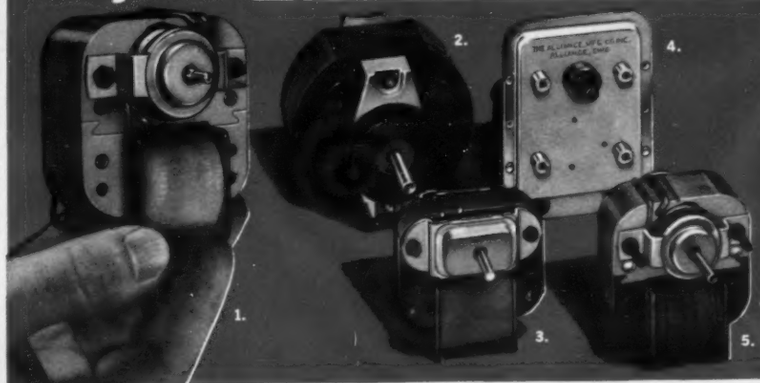
• **FOUR-WHEEL GRADER** has an unusual, hydrostatic drive train. Power source is a 220-hp, 6-cylinder diesel engine combined with a conventional transmission (up to 5 mph in work gear, up to 10 mph in road gear).

The gear transmission powers two separate hydrostatic axial-piston oil transmissions. Controls consist of two hand levers only, which adjust direction and speed of each side independently. As the operator moves one control forward and one control in reverse, unit turns on zero radius. Design avoids severe clutch wear of tracked vehicles with independently driven sides, but achieves equal maneuverability.

Front and rear wheels have identical 21.00-25 tires with cross-country profile for grades up to 55 percent. Attachments convert 19-ton unit into scraper or mobile crane. Chassis is protected by flat bottom pan with 18-1/2-inch clearance. The grader is a product of Henschel-Werke GmbH., Kassel, Germany. **R. F. S.**

Rely on ALLIANCE



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2. **"L" Motor**—Shaded pole motor for typewriters, business machines, etc.

3. **"H" Motor**—High starting torque, compact design for gear trains, air circulation, etc.

4. **"JSG" Gearmotor**—For rotisseries, vending machines, remote controls, etc.

5. **"JS" Motor**—Proven dependability! For fans, heaters, pumps, recorders and many others.

For the industry's most complete line of Sub-Fractional HP Motors

Alliance, world's largest producer of sub-fractional HP motors, offers the widest choice of standard and custom models, faster service, more for your money. Used in leading makes of phonographs, tape recorders, appliances, business machines, animated displays and other products—all can be customized to your own specifications.

Model	Voltage	Starting	Full Load		Input		Weight
		Torque oz./in.	Torque oz./in.	Speed RPM	Amps	Watts	
JSY 1101	117	1.0	0.4 (pull in)	3600	.295	18	1 lb. 14 oz.
L	117	6.5	8.0	3250	1.20	77	3 lb. 7 oz.
H	117	1.0	1.0	2500	.310	17	1 lb. 0 oz.
JSG	117	225	165	12-14	.490	25.5	1 lb. 7 oz.
JS	117	1.75	2.70	2900	.570	29	1 lb. 2 oz.

Write for complete catalog—price quotations upon request

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ALLIANCE MOTORS

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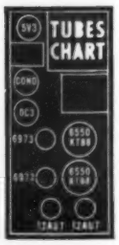
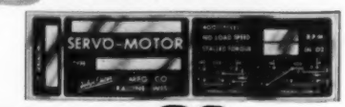
hot cold gas grease grime scuff shock vibra-tion!





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MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

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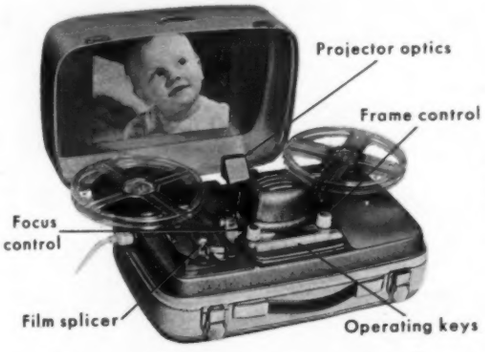
• **IN A 8-MM FILM PROJECTOR,** film travels horizontally as in a tape recorder. Operator sits behind compact, slab-like unit; projector doubles as film-editing device. Separate sound section is also flat, supports projector and uses its own carrying case as loudspeaker.

Core of the projector is a new optical system. An 8v, 50w lamp with integral reflecting mirror eliminates the conventional combination of concave mirror and condenser. As film moves past



optical head, three prisms serve to right the picture for projection through a 1:1.5, f = 20 mm lens system.

As soon as film is stopped, a centrifugal clutch drops a sieve-shaped metal plate with thermal insulation filter between lamp and film, protecting an individual frame from overheating. Cooling blower has separate drive, functions also when film transport motor stops. Selector adapts unit to any voltage between 110 and 240.

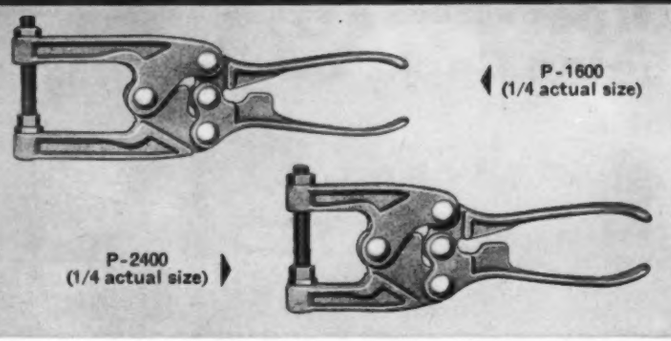
For editing, the inside of the projector cover is designed as a small screen. Film is advanced manually by a knurled knob; cut points are identified by a pushbutton marker. A splicer mounted on top of the projector insures cutting lines centered between perforations. Splices, which are only 1.4 mm wide, are prepared by a shaving head with end stops for width and scraping depth. As cuts are between frames, they are not visible during projection.

The separate sound section permits dubbing-in on 0.8-mm magnetic track from voice, tape, disc or radio phono jack. Voice blend-in is controlled by a microphone key which fades the preceding sound track to bring out text.

"Visacustic 8 flat projector" is a product of Niezoldi & Kraemer GmbH, Munich, Germany.

R. F. S.

Another step forward *KNU-VISE* TOGGLE PLIERS with 1600 & 2400 lbs. clamping force



In keeping with its reputation for providing the industry's most efficient toggle clamps and pliers, Lapeer Manufacturing Company has introduced new plier models—the P-1600 and P-2400 series.

Long and comfortable handles are a feature of these Lapeer Knu-Vise pliers. With average handload, these pliers provide a clamping force of 1600 and 2400 lbs. respectively. The P-1600 series has a throat depth of 2¼", and throat gaps of 1$\frac{3}{16}$, 3, 4 and 6 inches. The P-2400 series has a throat of 1¼" x 1¼". Each series is available with two opposing spindles. All models can be furnished with unlocking levers. The pliers are made from steel forgings, heat-treated, and cadmium plated.

Write for more information and remember—LAPEER KNU-VISE GIVES YOU MORE VALUE FOR YOUR MONEY.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

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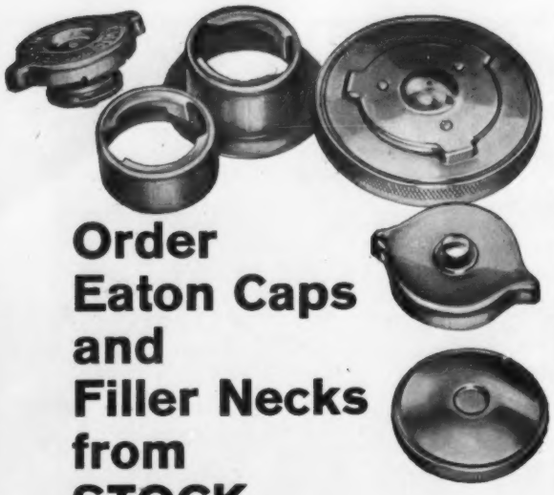
Usable Design Ideas



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IDEAS IN THE NEWS

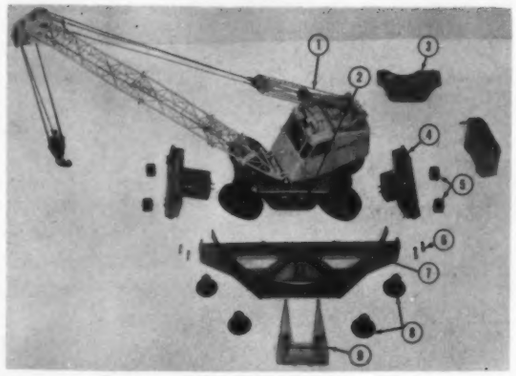
• **DETACHABLE SIDE-SUPPORT TABLES** increase load capacity and reach of a new crane. The boom is articulated; inboard boom section is box-shaped and has two vertical wheels in bottom which ride on circular rail segments mounted on side supports. This relieves crane turning table, adds to load-carrying capacity and permits safe extension of crane reach.

Basic capacity is 15,000 kg; capacity increases to 35,000 kg with addition of one side table and reaches a top rating of 40,000 kg with two tables. Reach increases from 3.0m to 5.2m and 6.0m in two steps.

For road transport, the side tables are pulled by the crane on a trailer; this keeps crane width within 2.5m limit set by local highway regulations. Permissible road speed is 35 mph. Crane is used to lift the tables from the trailer and attach them to the sides; for off-road movement, side tables can remain attached.

Unit is propelled by two "MAN" diesel engines which can act singly or together on both driving and operating gearboxes. Controls are pneumatic-hydraulic. The crane was designed by Maschinenfabrik Augsburg-Nuernberg, Work Nuernberg, Germany.

R. F. S.



1. Basic crane
2. Diesel unit basic equipment
3. Diesel unit detachable
4. Rear support table for added turning radius
5. Rear table supports
6. Linking pins
7. Side table
8. Side table support
9. Inboard boom segment

SCALE MODEL shows basic unit surrounded by building block components.

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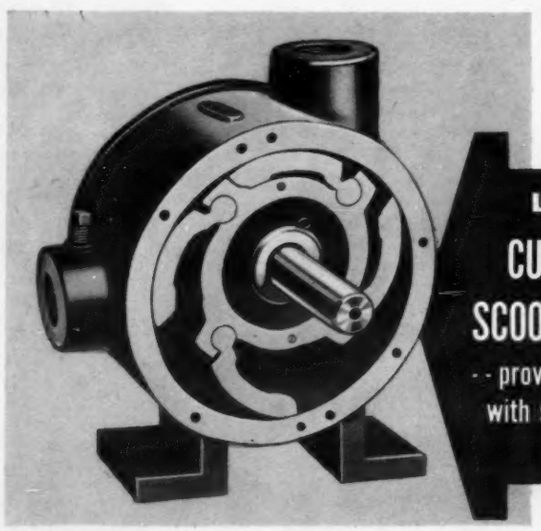

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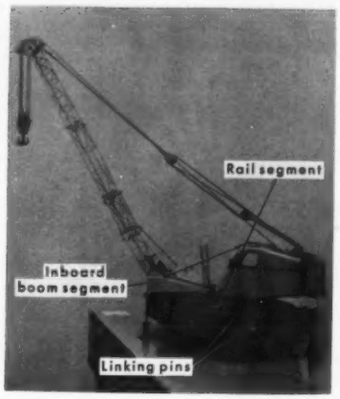

UNIT WITH SIDE TABLE

Meetings

Chicago, Ill. Sept. 18-20	ANNUAL MEETING, Standards Engineers Society, Hotel Sherman.
Milwaukee, Wis. Sept. 27	HYDRO-STATIC TRANSMISSIONS SEMINAR, Milwaukee School of Engineering, Allen-Bradley Hall of Science.
Utica, N. Y. Oct. 2-4	SEVENTH NATIONAL COMMUNICATIONS SYMPOSIUM, Institute of Radio Engineers.
Washington, D. C. Oct. 2-7	XIIIth INTERNATIONAL ASTRONAUTICAL CONGRESS, American Rocket Society.
Ann Arbor, Mich. Oct. 3-6	SEVENTH ANNUAL U. S. ARMY HUMAN FACTORS ENGINEERING CONFERENCE, Army Research Office, Office of the Chief of Research and Development, Institute of Science and Technology, University of Michigan.
Santa Catalina Island, Calif. Oct. 5-8	ANNUAL MEETING, American Society of Industrial Designers, St. Catherine Hotel.
Chicago, Ill. Oct. 9-11	NATIONAL ELECTRONICS CONFERENCE, Institute of Radio Engineers, American Institute of Electrical Engineers, et al, International Amphitheatre.

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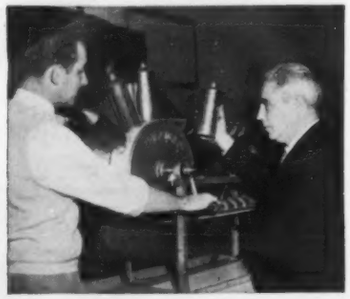

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PLANS AND CROSS-SECTIONS

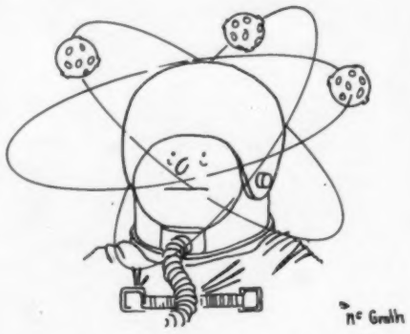
Flying Rings around the Moon

Pilots have learned to "fly" rings around the moon.

This was done while "flying" a space craft simulator in an attempt to find out if a pilot could change his flight path as he approached the moon from earth.

Paths of the simulated space ship "shot toward the moon" were set to miss the moon surface by 40 to 80 miles at speeds of from 8,200 to 8,700 fps at closest approach.

The pilot was given control of the thrust and torques about all three axes of the craft. The pilot saw a graph of the vehicle rate of descent and circumferential velocity, an altimeter, and vehicle attitude and rate meters.



The pilots soon became adept at "flying around the moon" and learned to establish orbits within a range of 10 to 90 miles above the lunar surface, according to M. J. Queijo and D. R. Riley of Langley Research Center.

Girl-Watching in the Gulf

Anna	Kara
Betsy	Laurie
Carla	Martha
Debbie	Netty
Esther	Orva
Frances	Peggy
Gerda	Rhoda
Hattie	Sadie
Inga	Tanya
Jenny	Virgy
Wenda	

A sea-going robot, Nomad I, will spend the next five months in the Gulf of Mexico watching for hurricanes.

The artificial "weatherman" is a platform 10 by 20 ft with four airtight aluminum wells filled with weather gear. At regular six-hour intervals, and every hour during high winds, the robot station will send weather data already measured and coded by the enclosed gear. At each transmission Nomad gives air and water temperatures, barometric pressure, wind speed and direction, and the direction of ocean surface currents. The robot is the joint product of the National Bureau of Standards, Department of Commerce and Navy's Bureau of Weapons.

Closed-Circuit Outer Space

A new training device for future astronauts has been proposed. It is a closed-circuit television system that would duplicate, as closely as possible, the visual environment of outer space, and involves a large "theater" with three high-intensity projectors and three screens.

The trainee would be placed in a model control room behind a mockup of the space vehicle, near the center of the "theater". There he would see televised images of the earth, the planets, the stars, the moon and the sun—realistically lighted and in their proper geometric relationships—as they would appear during an actual flight.

One studio would generate the basic picture of the star field. A second would use a turning globe to show the earth as it appears from high altitudes, with a battery of spotlights for the imitation "sun". The third studio would show a space station model for simulation of orbital rendezvous conditions. Different models could be used in simulated flights covering approaches to the moon, earth and other planets.

The relative motions of all the bodies concerned would be coordinated and synchronized in the composite picture. The project was suggested by T. F. Buddenhagen of Bell Aerosystems Co.

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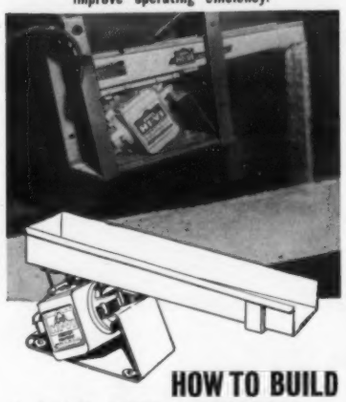

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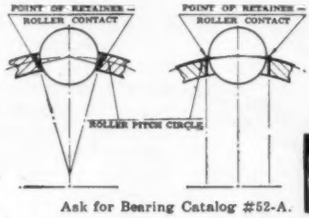

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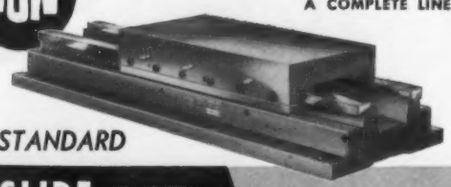

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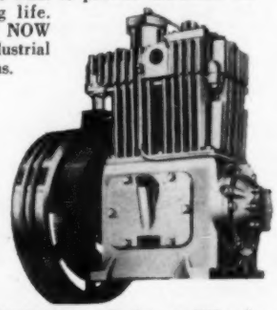

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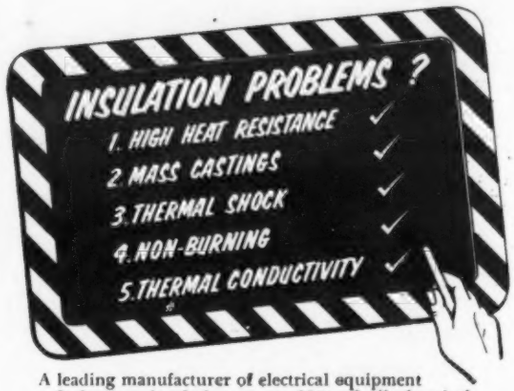

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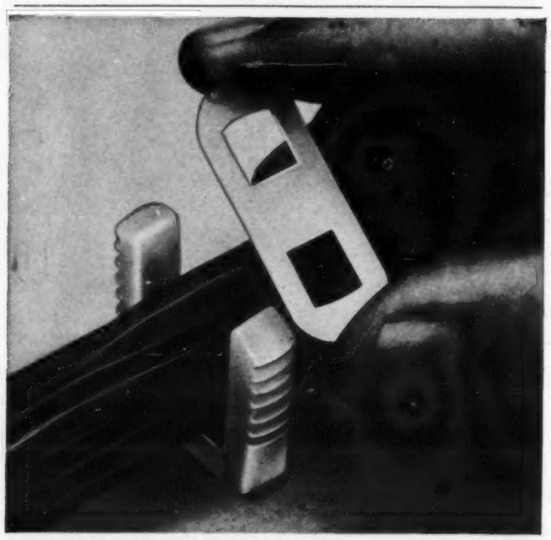

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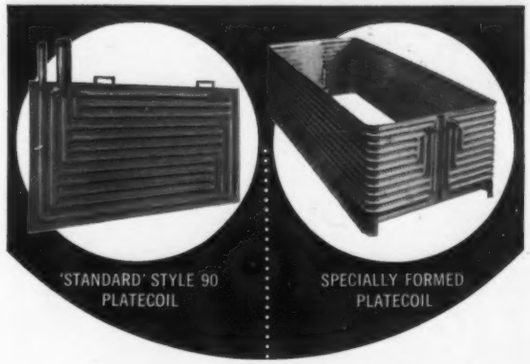

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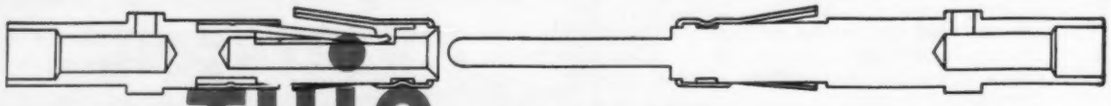

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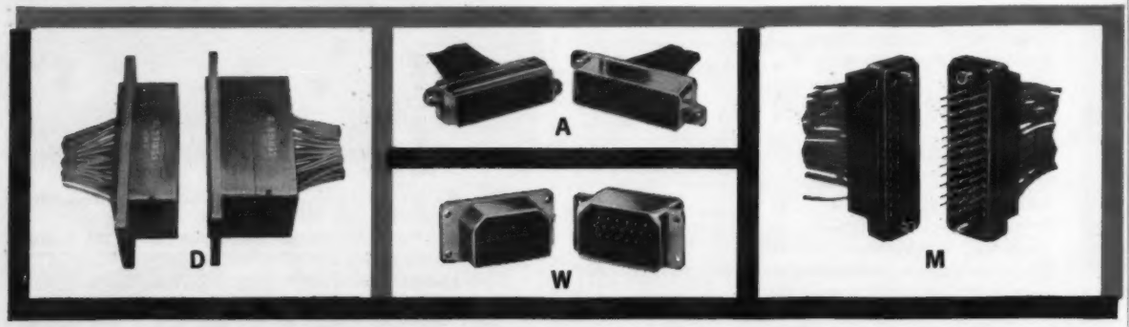

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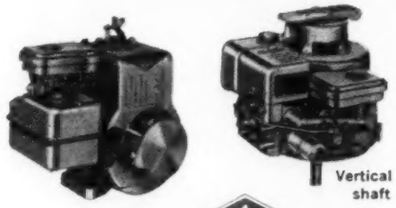

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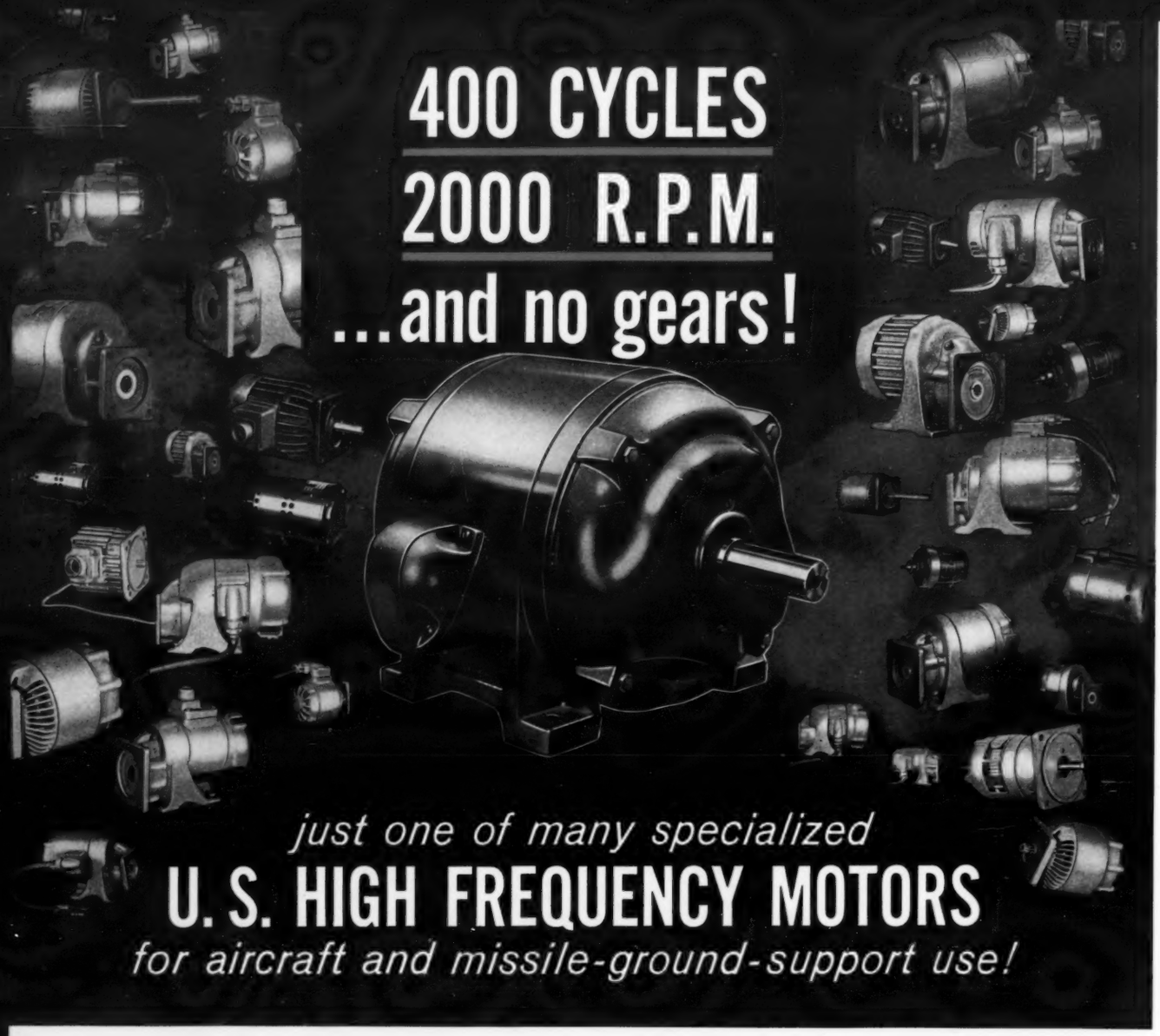

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